



ATTO Technology, Inc.

Diamond Storage Array VT-Class

Installation and Operation Manual

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Preface

This guide will take the technology-savvy user through the installation and maintenance of the Diamond Storage Array-VT.

The Diamond-VT was designed to meet your need for large amounts of easily accessible storage using proprietary Aggregated Data Transfer Technology (ADXT™) to merge the power of multiple, high performance ATA disk drives with the sustained data transfer rates required by sophisticated computer users.

Your comments help us improve and update our products. Contact us:

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1.0 Diamond Storage Array-VT Product Overview

The Diamond Storage Array-VT Class offers up to 30 Virtual Tape drives and up to 60 virtual tapes in a rack mount or floor model configuration.

The Diamond-VT appears and functions to ISV (Independent Software Vender) applications as if it were a traditional tape device although it is actually an array of ATA disk drives. Virtual tape provides increased performance for restore and backup operations, RAID protection of data, and compatibility with existing software and backup procedures. Virtual Tape can be used anywhere traditional tape is used to augment and enhance existing tape drive/library investments.

With the cost effective approach of using ATA disk drives, you can add more storage capacity as your needs grow without the costs of other disk storage technologies. You can also improve the performance and capacity of the Diamond-VT cabinet as technology progresses by simply replacing disk drive sleds and host interface cards.



The Diamond-VT is operating system independent and supports all popular computer hardware platforms and network environments.

Two interface options are available: a 2-gigabit Fibre Channel interface and an Ultra160 SCSI interface.

The Diamond-VT is a fully populated, turnkey solution with drives pre-installed. It is fully supported by a highly trained customer service and engineering staff.

The Diamond-VT uses Aggregated Data Transfer Technology (ADXT™) to merge the performance of multiple ATA drives to achieve sustained, full bandwidth data transfer rates. ADXT provides end users with the power and sophisticated data control needed to take moderately priced ATA disk drives, combine them in a disk storage array, and power them to the performance levels of SCSI or Fibre Channel disk arrays.

Diamond-VT features

- Up to 7.2 Terabytes initial configuration (expandable with future drive technology)
- Supports most major operating systems and ISV software applications
- Configurable up to 30 Virtual Tape Drives



- Aggregated Data Transfer Technology (ADXT™) for high performance/scalability
- Ultra ATA 100 megahertz (Mhz)
- RAID Level 10 and RAID Level 5 configurable
- Zoning capability compatible with third party servers, switches and with deliverables from industry standards organizations.
- Hot spare sleds: replace degraded sleds with spares on the fly using software
- Staggered drive spin-up to reduce peak power demand
- Tagged command queuing to process up to 255 simultaneous data requests
- RS-232 management for local management control; Ethernet option available for setup connection only
- ExpressNAV™ browser-based user interface
- Two power supplies capable of 85-264 V (rated 100-240V AC) operation (340 watts each)
- UL, TUV and CE marked and compliant
- Internal thermal and power management
- Redundant hot swappable power supplies with integrated thermal and power management
- Floor model cabinet or 19" 3U rack mount

Exhibit 1.0-1 Back of rack mount model, Diamond-VT. Left: 2 gigabit Fibre Channel. Right: SCSI.



Fibre Channel model

- 2 gigabit Fibre Channel Port (single or dual channel)
- SFP-based Fibre Channel interface supports long wave and short wave optical cables
- Built-in hub for daisy-chaining
- Up to 9,500 I/Os per second per port
- Up to 240 MB/sec. sustained Fibre Channel transfer rates per interface

SCSI model

- Ultra 160 SCSI bus
- Dual stacked VHDCI connectors for daisy-chaining and termination
- SCSI Target ID selection switch
- Support for single-ended and LVD SCSI
- No onboard termination



2.0 Diamond-VT Technical Overview

The Diamond-VT uses Aggregated Data Transfer Technology (ADXT) to achieve the high data transfer performance you need. ADXT merges the performance of multiple ATA drives together to achieve sustained, full bandwidth Fibre Channel data transfer rates.

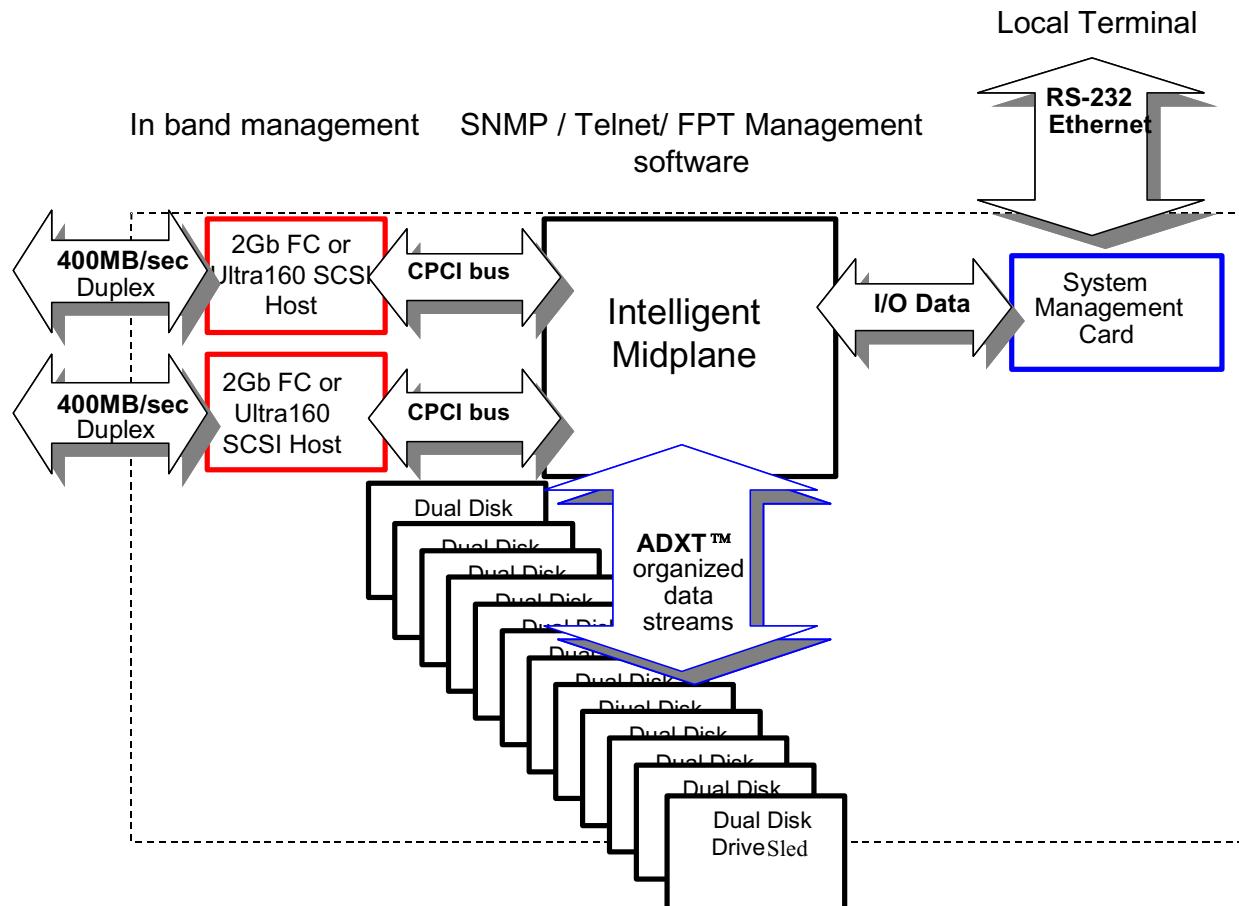
Unlike other storage arrays which use expensive SCSI or Fibre Channel disk drives to achieve performance, the Diamond Series uses lower cost ATA disk drives combined with an intelligent midplane to create a storage array with exceptional price and performance characteristics.

The intelligent midplane contains hardware and software which provide the proprietary ADXT, a switched data management and data movement

technology, to create a higher performance storage solution.

Using this technology, we are able to provide a storage array that delivers faster sustained data transfer rates as well as impressive I/Os per second at a new price point in the storage market. The Diamond Array is made up of dual SCSI or Fibre Channel host interface cards, the intelligent midplane, a system management card, and 12 independent disk drive sleds containing up to 24 ATA disk drives.

Exhibit 2.0-1 Data pathways and architecture for Fibre Channel operation



ADXT Powers ATA to New Levels

The original notion of RAID was to build high capacity, reliable storage subsystems using large numbers of inexpensive disk drives. Thus its original definition: *Redundant Array of Inexpensive Drives*. Over time that definition became *Redundant Array of Independent Drives* and the inherent cost advantage in a RAID system was lost. The Diamond Series provides a high capacity, high performance and highly reliable disk array that uses the merged power of many inexpensive ATA disk drives.

Intelligent Midplane The heart of the Diamond Series storage array is the intelligent midplane with ADXT to sum or *aggregate* the data rates of individual ATA disk drives to create high data transfer rates. This technology enables features such as serverless backup, advanced error protection, metadata storage techniques, virtualization software, thermal management and advanced enclosure services.

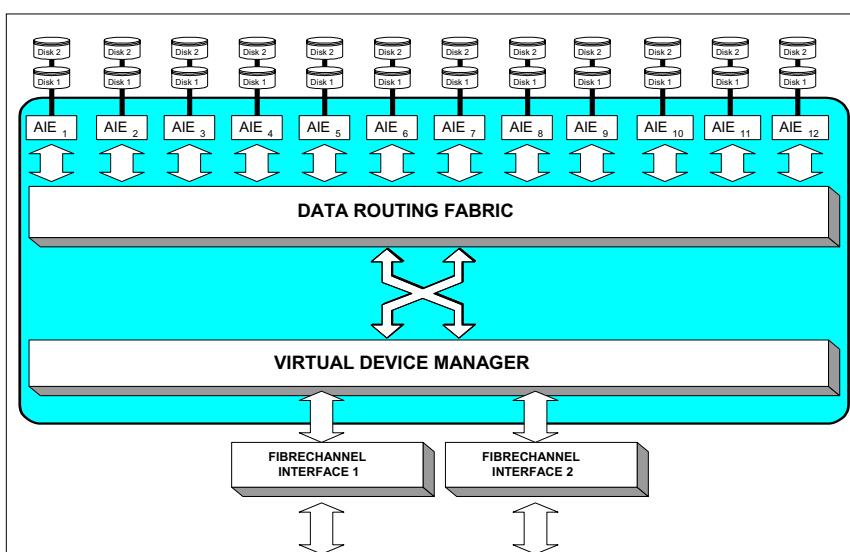
The midplane contains a combination of custom Application Specific Integrated Circuits (ASICs), processors and proprietary embedded software. It is divided into three main processing sections which handle the data being read or written to the ATA disk drives from the Fibre Channel or SCSI host interfaces. The Virtual Device Manager (VDM), Data Routing Fabric (DRF) and ATA

Interface Engines (AIE) organize data streams for storage or retrieval.

Virtual Drive Manager Data is accessed through Virtual Drives using an implementation of the standard SCSI protocol controlled by the Virtual Device Manager. The VDM adds capabilities such as RAID, data management services, enclosure management services, serverless backup, data replication using SCSI Extended Copy and LUN mapping.

Data Routing Fabric Incoming or outgoing data is routed between the ATA Interface Engines (AIE) and the Fibre Channel or SCSI interface by the custom Data Routing Fabric ASIC, a high speed, low latency transfer fabric with more than 2 GB/sec. of bandwidth supported by up to 512 Megabytes of memory.

ATA Interface Engine (AIE) The interface to each pair of drives is through a custom ATA Interface Engine ASIC. The AIE implements the typically software-intensive ATA interface completely in silicon. Each AIE contains a dedicated ATA protocol processor to completely automate command and protocol processing. Automated command overlapping and queuing maximizes the performance of multi-threaded I/O. The AIE transfers data using double-clocking technology at 66 megabytes per second. The Diamond-VT contains 12 AIEs for a parallel transfer rate of 792 megabytes per second. In addition to guaranteeing data transfer integrity with automatic CRC checking, the command and status transfers are validated using a patent pending technology unique to the AIE.



3.0 Installation Instructions

If you are familiar with the Diamond-VT, Fibre Channel, SCSI and RAID configurations, you may set up and configure the Diamond-VT using these instructions. Find details, illustrations and other guidance for more involved operations and special cases in the rest of this manual.



CAUTION

Before configuring the Diamond-VT, ensure that any computer data to be stored on the array is properly backed up and verified. The operation and storage of computer data on any disk storage array should be accompanied by a regular program of computer data backups and verification for the data stored on such an array.

The Manufacturer is not responsible for the loss of any data stored on the Diamond-VT under any circumstances and any special, incidental, or consequential damages that may result thereof.

Three major steps are required to set up the Diamond-VT

- 1 Physically set up Diamond-VT
- 2 Connect to Ethernet
- 3 Configure Virtual Tape

Step 1: physical setup

- 1 Make sure the Diamond-VT is mounted properly and has adequate air flow around it.
- 2 Insert the appropriate connector into the interface card in the back of the Diamond-VT.
- 3 Connect the Fibre Channel or SCSI cable from your host computer system to the connector. To use ExpressNAV browser-based management interface and configure your Diamond-VT, you must connect to the Ethernet port.
- 4 To set up the Ethernet connection: connect a cross-over cable (for a direct connection to a PC) or regular network cable from a network device to the RJ45 Ethernet port on the Ethernet management card on the front of the Diamond-VT.

Step 2a: set up the Ethernet connection

The Diamond-VT supports service operations over the RS-232 serial port using standard

terminal emulation software available with most systems.

- 1 Connect a DB-9 null modem serial cable between the port marked RS-232 on the front of the Diamond-VT and the computer's serial port. The cable must be no longer than three meters.
- 2 Make sure the power switches on the power supplies on the rear of the unit are in the Stand-by position.
- 3 Plug in the power cords to the back of the unit, then into an appropriate power source (100-240 VAC).
- 4 Reboot your host computer system.
- 5 Press the Stand-by power switch for each power supply on the Diamond-VT to the ON position.
- 6 Upon successful power up and diagnostics, the unit displays the POST (power up self test) information.

The Diamond is now in Command Line Interface mode. You may modify the setup of the Diamond-VT using the CLI (see *CLI: Interface via ASCII-based Commands* on page 27), but the easiest method to configure the array is by using ATTO ExpressNAV software, a graphical user management interface accessed through a standard Internet browser. See *ATTO ExpressNAV: Browser-based Interface* on page 23.

Step 2b: connect to Ethernet

If the Diamond-VT is attached to a DHCP server

- 1 At the **Ready** prompt after **POST** (see Step 6 above), type **set IPDHCP enabled**
- 2 Type **SaveConfiguration Restart**
- 3 At the **Ready** prompt after **POST** (see above), type **get IPAddress**
- 4 Enter this address into your browser.
- 5 The ATTO ExpressNAV screen appears. Log in using the Telnet defaults:

Username: Telnet

Password: Diamond

- 6 Follow the screens to find information about the array or to configure the array from the factory-default settings. The Diamond-VT may be set up in a RAID Level 5 or RAID Level 10 configuration with or without Hot Spare sleds and/or set up in a zoned configuration.

If the Diamond-VT is not attached to a DHCP server and you wish to change the defaults

- 1 At the **Ready** prompt after **POST** (see above), type **set IPAddress [desired IP address]**.
- 2 Type **set IPSubnetMask [desired IP Subnet Mask]**
- 3 Type **set IPGateway [desired IP Gateway]**
- 4 Type **SaveConfiguration Restart** to save the configuration and restart the Diamond-VT
- 5 After the powerup and POST complete, type the IP address from step 1 above into your browser.
- 6 The ATTO ExpressNAV screen appears. After logging in (refer to **Step 2b: connect to Ethernet**, Step 5 on page 5), follow the screens to find information about the array or to configure the array from the factory-default settings. The Diamond-VT may be set up in a RAID Level 5 or RAID Level 10 configuration with or without Hot Spare sleds and/or set up in a zoned configuration.

Step 3: set up Virtual Tape configuration

The simplest way to set up Virtual Tape configurations is to use the ExpressNAV interface. Refer to *ATTO ExpressNAV: Browser-based Interface* on page 23 for more information on the interface. After logging in (refer to **Step 2b: connect to Ethernet**, Step 5 on page 5), follow the screens to find information about the array or to configure the array from the factory-default settings.

If you use the CLI, the command **QuickTape™** sets up Virtual Tapes using the following format:

```
set QuickTape [RAID5|RAID10] [# tape
volumes] [# tape drives] <enabled>
<Barcode Prefix>
```

Hot Spares are not available for all Virtual Tape configurations. You must designate **enabled** to allow Hot Spare sleds or **disabled** to forgo Hot

Spare sleds. Refer to and *Optional Hot Spare Sled* on page 50 for more information and examples.

Each Hot Spare sled configuration requires a certain number of Hot Spare sleds. These sleds, once designated as Hot Spares, are not available for other use.

- RAID Level 10: 10 drive sleds and two Hot Spare sleds (sleds 11 and 12).
- RAID Level 5: 10 drive sleds and two Hot Spare sleds (sleds 11 and 12)
- RAID Level 5: five drive sleds (sled positions 1 through 5) and one Hot Spare sled (sled 12).

You may specify the first four to six alphanumeric characters of a tape bar code, used by tape backup software. The remaining four characters will be entered by the system automatically to identify the tape number. Refer to *Virtual Tape* on page 49 for more information and examples.



Note

The maximum number of tape volumes and tape drives for RAID Level 5 is 30.

The maximum number of tape volumes and tape drives for RAID Level 10 is 15.

You must designate either enabled or disabled for the Hot Spare option when designated a barcode prefix.

All arrays using RAID level 10 and Hot Spare sled options must be fully populated.

Configuration examples

RAID Level 10 with Hot Spare sleds

```
set QuickTape RAID10 15 1 enabled
SaveConfiguration Restart
```

The Diamond-VT will be configured into RAID Level 10 with one tape drive, 15 tape volumes and two Hot Spare sleds.

RAID Level 5 and no Hot Spare sled

```
set QuickTape RAID5 30 2
SaveConfiguration Restart
```

The Diamond-VT will be configured into RAID Level 5 with two tape drives and 30 tape volumes.

3.1 Diamond-VT Components

The Diamond-VT has been designed to be easy to use, maintain and upgrade. It features a durable steel outer case and modular components in either a floor or a rack mount model.

Immediately upon receipt, check the shipping carton for damage from mishandling. Contact us at once via the means that is easiest for you (see *Warranty* on page A-xv) if the carton has been mishandled or displays any signs of damage.

The front of the Diamond-VT provides access to the management card and disk drive sleds. The

rear of the unit holds the host interface cards, power supplies and blower assemblies.



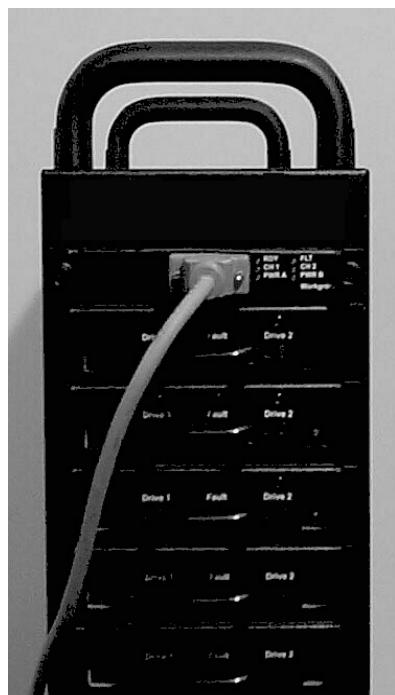
CAUTION

All modular components must be replaced by qualified personnel only. Refer to *Hot Swap Operating Instructions* on page 69.

Floor model

The management system card is at the top front of the case. At its center is a DB-9 serial RS-232 port, a connection for setup, monitoring and upgrade of the unit from any computer system with an RS-232 interface. The optional 10/100 BaseT Ethernet management services card enables Telnet-based monitoring and management. It also provides the ability to update the firmware in the array via FTP.

LEDs to the port's right indicate fault, unit ready, host interface cards A and B installation status, and the power status for each power supply.



Below the management system card are individual disk drive sleds which also have LEDs for each drive's status. Each sled contains two hard drives. Up to 24 hard drives may be installed on the 12 sleds. Empty bays should be covered by blank faceplates

or empty sleds. Access is provided by loosening two screws and gently pulling on the sled handle. On the rear of the unit are blowers which support hard drive, cabinet and power supply cooling. The blowers are held in by removable screws. Correct operation is displayed by a LED at the top of each panel.

The power supplies for the Diamond-VT, also in the rear of the unit, are accessible by loosening two screws and pulling on the power supply module handle. The power standby on/off switch is at the top of each module. A yellow LED indicates *caution* and a green LED indicates *on*. The power cord socket is at the bottom of each power supply.

Between the power supplies and blower assemblies are two slots that hold the Host Interface cards. The HIC is the connection point into the Diamond-VT and is available in a 2-Gigabit Fibre Channel or Ultra 160 SCSI. Host Interface cards have *fault* and *on-line* or *fault* and *activity* LED indicators, depending on the model.

SCSI The SCSI card faceplate has a rotary binary-coded hex switch to set the SCSI ID of the Diamond-VT. The SCSI card also has an in channel, to connect via cable to the unit's communication source, and an out channel, available for daisy-chaining arrays together or to complete termination using an external LVD terminator.

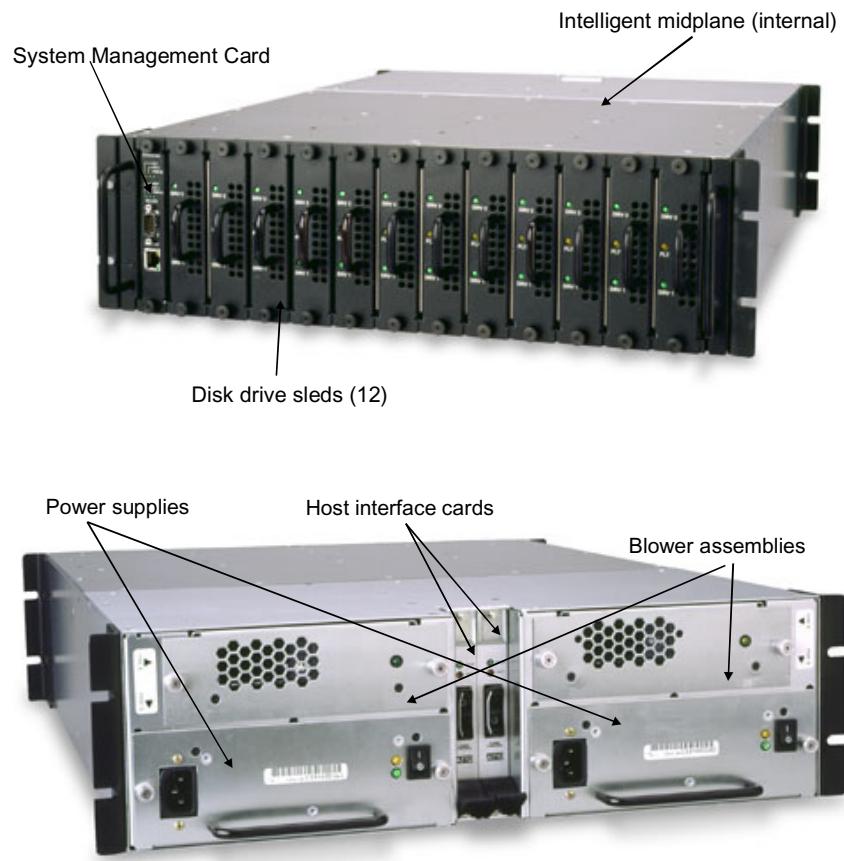
Rack mount model

The system management card is at the left front of the case. At its center is a DB-9 serial RS-232 port which allows a connection for setup, monitoring and upgrade of the unit from any computer system with an RS-232 interface. The optional 10/100 BaseT Ethernet management services card enables Telnet-based monitoring and management. It also provides the ability to update the firmware in the array via FTP. LEDs farthest to the left indicate fault, unit ready, Host Interface cards A and B installation status, and the power status for each power supply.

To the right of the system management card are individual disk drive sleds which also have LED indicators for each drive's status. Each sled contains two hard drives. Up to 24 hard drives may be installed on the 12 sleds. Empty bays should be covered by blank faceplates or filled with empty sleds to promote effective cooling. Access is provided by loosening two screws and pulling on the sled handle.

In the rear of the unit are the blower assemblies which support hard drive, cabinet and power supply cooling. Correct operation is displayed by a LED at the top of each panel. The blowers are held in place by removable screws.

The power supplies for the Diamond-VT are accessible by loosening two screws and pulling on the power supply module handle. The power standby on/off switch is at the top of each module. A yellow LED indicates *caution* and a green LED



indicates *on*. The power cord socket is at the bottom of each power supply.

Between the power supplies and blower assemblies are two slots that hold the Host Interface cards. The HIC is the connection point into the Diamond-VT and is available in a 2-Gigabit Fibre Channel, or Ultra 160 SCSI. Host Interface cards have *fault* and *on-line* or *fault* and *activity* LED indicators, depending on the model.

SCSI The SCSI card faceplate has a rotary binary-coded hex switch which allows you to set the SCSI ID of the Diamond-VT. The SCSI card also has an in channel, to connect by a cable to the unit's communication source, and an out channel, available for daisy-chaining arrays together or to complete termination using an external LVD terminator.

3.2 Diamond-VT Physical Setup

The Diamond-VT is shipped completely assembled with two 120 VAC power cords for use in the United States and Canada.

Immediately upon receipt, check the shipping carton for damage from mishandling. Contact us at once by the means easiest for you (see *Warranty* on page A-xv) if the carton has been mishandled or displays any signs of damage.

Floor Model

The Diamond-VT is heavy (about 92 pounds fully loaded) and requires two people to lift and carry it safely. Place the Diamond-VT on a level surface and make sure there is adequate space in the front and back of the unit for proper cooling and airflow. Continue with the general instructions.

Rack Mount

The Diamond-VT fully loaded is heavy (about 86 pounds). The unit should be handled with care and requires two people to lift, carry and/or install it safely.

The Diamond Array can be mounted via several different methods in a 19" rack with 3U (5.25") of vertical space required. Air flow should not be restricted in any way.

Installation in a rack may create a differential between the room ambient temperature and the internal ambient temperature in the rack. While the maximum internal operating temperature of the Diamond-VT is 47°C, you should not run the system at the maximum temperature for extended periods. Therefore, ensure that the room ambient temperature is kept below 30°C for best operation.

Each side of the rack mount Diamond-VT chassis has three pairs of mounting holes. One is located near the front of the rack, one near the unit's center of gravity, and one near the rear of the rack. The holes accommodate 10/32 screws but the screws can protrude no farther than .375 inches into the rack.

Spaced rail pairs in some rackmount cabinets.

You can mount the Diamond-VT using two sets of rail pairs spaced to accommodate the overall length of the unit (approximately 23 inches). Mount using the rack mount brackets on the front and rear of the unit fastened to the rail pairs using 10/32 pan head screws with lock and flat washers.

Rack mount cabinets with stationary shelf or tray system. The shelf or tray must be able to support at least 125 pounds. The shelf or tray must be installed and secured to the rack before installing the Diamond-VT. Secure the front of the array to the rack with 10/32 screws, locks and flat washers.

Sliding shelf or tray type systems should never be used under any circumstances.

Two point open rack system. The rack must be strong enough to support the Diamond Array properly. Mounting brackets should be moved to the centermost mounting holes and secured using 10/32 screws.

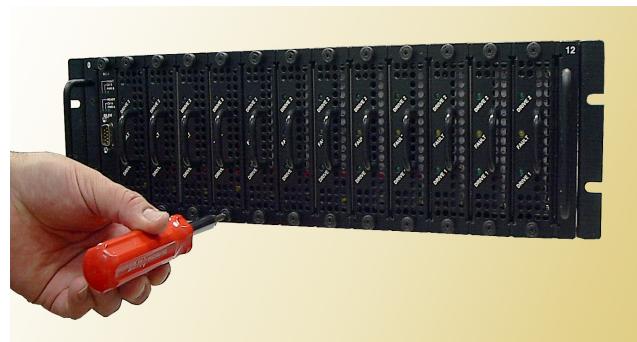


CAUTION

Do not mount multiple Diamond-VT units on a two-rail rack or mount the array above the midpoint of a two-rail rack system.

Do not mount the Diamond-VT on any kind of rail-type system. The array is too heavy and does not have the proper hole pattern for rails.

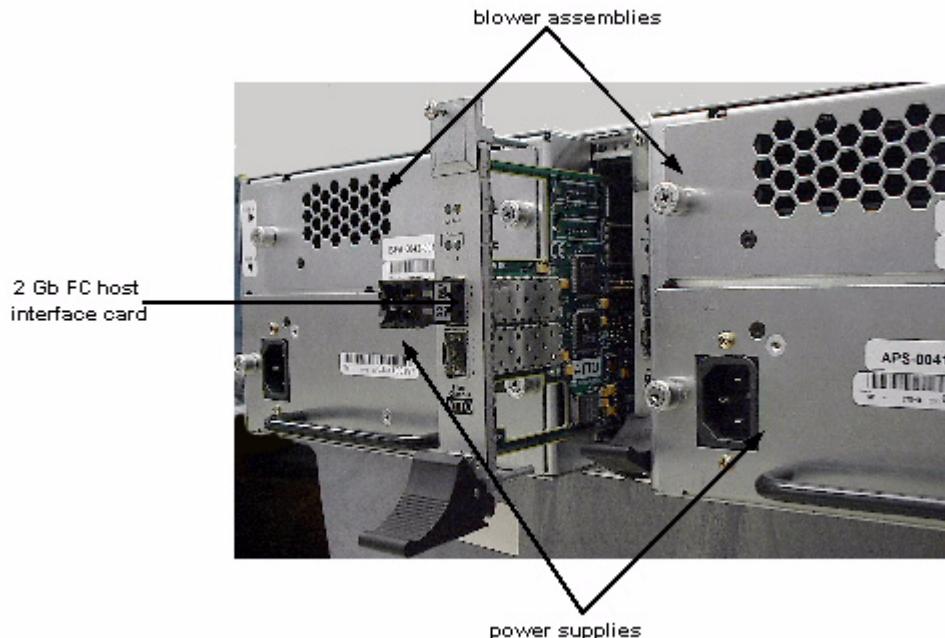
Insure the Diamond-VT has adequate air flow and continue with the general instructions.



General Instructions

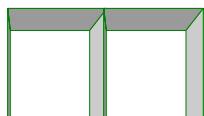
- 1 Insert the proper connector into the Host Interface Card in the back of the Diamond-VT. (See *Connecting a Fibre Channel Array* on page 11 or *Connecting a SCSI Array* on page 13).
- 2 Connect the cable (Fibre Channel or SCSI) from your host system to the Host Interface Card connector on the back of the Diamond-VT. The cable you use depends upon your application, the environment and distance.
- 3 Make sure the power switches on the power supplies on the rear of the unit are in the stand-by position. Plug in the power cords to the back of the unit, then into an appropriate power source (100-240 VAC). The power source must be connected to a protective earth ground and comply with local electrical codes. Improper grounding may result in an electrical shock or damage to the unit.
- 4 Press the stand-by power switch for each power supply to the ON position. When the green power LED on the back of the unit is lit, the power supply is fully operational and delivering power to the system. The power LED on the front of the array lights once the firmware begins to execute.
When the power is turned on, the LEDs on the front of the Diamond-VT flashes twice. Drives spin up in groups of three, about every one to two seconds. The individual LEDs blink. After all available drives have spun up, the individual drive LEDs stays lit. When all available drives are operational, the *ready* LED on the top front panel of the management card remains lit.
- 5 Reboot your computer
- 6 Determine the best configuration for your needs and refer to the rest of this manual for more detailed explanations and configuration information.

Exhibit 3.2-1 Back side of a rack mount, Fibre Channel Diamond-VT with blower assemblies on top, power supplies at the bottom, separated by the Host Interface Card.



3.2.1 Connecting a Fibre Channel Array

The Diamond-VT supports up to two Fibre Channel Host Interface Cards (HIC). Physical connections and CLI commands contribute to the Fibre Channel topology.



2 Gb HIC uses
2 SFPs to connect up
to 2 FC cables

The Diamond-VT may have two Fibre Channel Host Interface Cards (HIC). Each HIC is connected by a Fibre Channel cable via an SFP (small form factor pluggable) module into a

point-to-point or loop Fibre Channel topology.

- 1 Install the SFP according to the manufacturer's instructions.
- 2 Insert the SFP into the Fibre Channel Host Interface Card in the back of the Diamond-VT.
- 3 Insert the correct cable.

The cable you use depends upon your application, the environment and the distance required for your storage area network.

To comply with FCC and CE EMI for the 2-gigabit Host Interface Card, use fiber optic cables.

Exhibit 3.2.1-1 Fibre Channel cable options

Cable length	Cable type	Cable size
<10 meters	Unequalized copper	
>10 <30 meters	Equalized copper	
Up to 175 meters	multi mode fiber optic	62.5 micron
Up to 500 meters	multi mode fiber optic	50 micron
Up to 10 kilometers	single mode fiber optic	9 micron

Each HIC has two ports and an on-board hub. Each port has an SFP module to connect to Fibre Channel. Each HIC is independent of the other, so that one may be connected into a point-to-point topology and the other into a loop. However, if

one port in a HIC is connected into a point-to-point topology, the other port cannot be used. One of the advantages of using loop topology for Fibre Channel connections is that it allows Diamond-VT units to be daisy-chained together. See Exhibit 3.2.1-2.

Autoconfiguration

The Diamond-VT automatically determines if the Array HICs are in loop or point-to-point topologies.

If you wish to see how the unit has been set up, go to the CLI commands and type **Info** or go to the **Status** page of the ExpressNAV interface. The return displays the data rate and connection mode for each HIC (FC 0 and FC 1).

Manual configuration

You may manually configure the Diamond-VT using CLI commands (see *CLI: Interface via ASCII-based Commands* on page 27.) or access the **Fibre Channel** page of the ExpressNAV interface.

The **FCConnMode** CLI command specifies the Fibre Channel topology for both HICs on a Diamond-VT. Options are loop only (loop), point-to-point only (ptp), loop preferred (loop-ptp) or point-to-point preferred (ptp-loop).

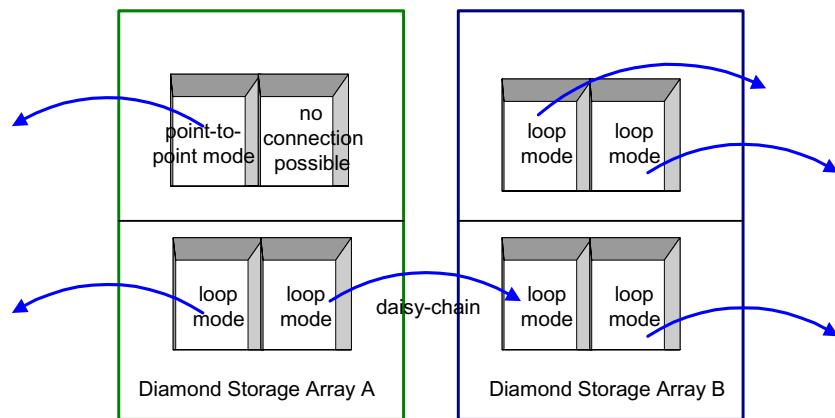
Loop connects to either an FC-AL arbitrated loop or a fabric loop port (FL_Port) on a switch.

Point-to-point (ptp) connects to a direct fabric connection, such as an F port on a switch.

Loop-ptp allows the Diamond-VT to determine what kind of connection to use, but tries to connect in loop mode first, then point-to-point mode.

Ptp-loop allows the card to determine what kind of connection to use, but tries to connect in point-to-point mode first, then loop mode.

Exhibit 3.2.1-2 Possible 2 gigabit Fibre Channel physical connections depending on which Fibre Channel connection mode has been selected.



3.2.2 Connecting a SCSI Array

The SCSI Diamond-VT uses a VHDCI connector and SCSI cables to connect to a host. It automatically detects the type of Host Interface Card it is using without any intervention.

To connect the SCSI Diamond-VT

- 1 Insert a SCSI VHDCI connector into the Host Interface Card in the back of the Diamond-VT.



- 2 If the SCSI Diamond-VT is the last device on the bus, you must attach a VHDCI terminator to one connector of the SCSI Host Interface Card

or connect a cable between the second connector and the next device on the SCSI bus.

- 3 The SCSI Host Interface Card has a rotary binary-coded hex switch which allows you to set the SCSI ID of the HIC. Be sure the selected ID is different from all other SCSI devices on the bus.



Note

If slower devices are connected on the same SCSI bus as the Ultra 160 Diamond-VT, the bus communicates at the rate of the slowest device.

Exhibit 3.2-1 SCSI cable options.

	Bus speed, MB/sec. max.	Bus width, bits	Max. bus lengths, meters		Max. device support
			Single-ended	LVD	
SCSI-1	5	8	6	-	8
Fast SCSI	10	8	6	-	8
Fast Wide SCSI	20	16	6	-	16
Wide Ultra SCSI	40	16	3	-	4
Wide Ultra SCSI	40	16	1.5	-	8
Wide Ultra 2 SCSI	80	16	-	12	16
Ultra 3 or Ultra160 SCSI	160	16	-	12	16

Exhibit 3.2-2 SCSI interface cards: left without terminators attached; right with a terminator attached.



4.0 Accessing the Diamond-VT

Communicate with the Diamond-VT through the Fibre Channel link, the RS-232 port or the Ethernet port using Command Line Interface commands or ATTO ExpressNAV, an integrated user management console.

You may configure and tune the Diamond-VT for different environments and applications, update the firmware, monitor internal power and temperature status, report on hardware diagnostics and log failures.

Three avenues are available:

- In-band SCSI over Fibre Channel and over SCSI
- RS-232 port
- Telnet and SNMP over Ethernet

The following chapters describe how to access the Diamond-VT and use the Command Line Interface or ATTO ExpressNAV, an integrated user management console.

Command Line Interface

The Command Line Interface provides access to the Diamond-VT through ASCII command lines.

An initial display, after powering up the unit or restarting the firmware, contains the information in Exhibit 4.0-1. Once the initial display is complete, with the word **Ready**, you are in the Command Line Interface mode.

Type **Help** to display a list of all commands available.

ATTO ExpressNAV

ATTO ExpressNAV is an integrated configuration tool accessible through an Ethernet connection. Platform independent, ExpressNAV contains all the current capabilities of the CLI in a user-friendly GUI console. A menu on each page provides access to information and configuration operations.

Refer to *ATTO ExpressNAV: Browser-based Interface* on page 23 for more information on the program.

In-band SCSI over Fibre Channel

In-band SCSI commands (Write Buffer and Read Buffer) may be issued to the Diamond-VT Fibre Channel port to manage configuration via two mechanisms:

- In-band CLI over SCSI, where ASCII CLI commands, may be issued via Write Buffer. All CLI commands except Zmodem are supported.
- ID/value, where the application program uses a SCSI CDB (command descriptor block) to select the buffer ID of the configuration parameters to be affected, and the new value of the parameter. Most configuration options are available.

RS-232 port

The Diamond-VT provides remote service operations over the RS-232 serial port using standard terminal emulation software available with most systems.

Set the following serial parameters in your terminal program:

- Bits per second: 115200
- Data Bits: 8
- Parity: None
- Stop Bits: 1
- Flow Control: None.
- Terminal type: ASCII
- Echo: on

Ethernet port

The 10/100 BaseT Ethernet port provides Telnet- or SNMP-based monitoring and management.

The default IP address is 10.0.0.1; the default subnet mask is 255.255.0.0. Change these parameters using the RS-232 port or Telnet. The Diamond-VT should first be configured for the network using the RS-232 port to establish the correct IP address.

SNMP

SNMP, or Simple Network Management Protocol, is an application layer protocol that allows network devices to exchange management information. Through a combination of standard and custom MIBs (Management Information Base), the Diamond-VT provides status and error indications to an SNMP server, allowing the

Array to be managed with other devices in a complex system through a common interface.

You use CLI commands to configure up to six unique Trap addresses. A trap is a way for the Diamond-VT to tell the SNMP server that something has happened.

Exhibit 4.0-1 The POST information displayed after boot of the Diamond-VT.

```
Initialization Complete

Diamond Storage Array
(c) 2004 ATTO Technology, Incorporated.

Firmware version A21R release date Apr 30 2004, 11:14:42 Build A21R

Power-On Self-Test Completion Status: GOOD
128 Megabytes of RAM Installed.

Interface Port 0 is not installed.
Interface Port 1 is not installed.

Interface 0 World Wide Name = 20 00 00 10 86 10 45 64
Interface 1 World Wide Name = 20 00 00 10 86 10 45 64

Diamond Array Serial Number = "MIDP100463"
Diamond Array Name = " "
System Serial Number = " "
Active Configuration = ATTO
DiamondClass = (T) 84
Internal Temperature = 25 C [5 - 47]
ErrorLog Contents: NO ERRORS
For help, type HELP.

Ready.
```

4.1 In-band CLI Over Fibre Channel

In-band Command Line Interface (CLI) configures and manages the Diamond-VT using SCSI-based CLI commands over a Fibre Channel port connection.

In-band CLI allows a programmer to configure the Diamond-VT while it is moving data. Using a programmer's interface, CLI commands as described previously in this manual may be implemented.

In-band CLI is implemented as part of LUN 0. It uses a different LUN than the Diamond-VT, and reports as a Storage Enclosure Services (SES) device (device type 0x0D).

LUN 0 is visible on all Fibre ports but is actually a single unit. The default value for LUN 0 is 0x00.

LUN 0 must be reserved for each Write Buffer/Read Buffer pair, using the SCSI Reserve command to insure integrity of the in-band CLI session.

- 1 An initiator (host) sends a SCSI Reserve command to LUN 0.
 - If LUN 0 is not reserved by another initiator, LUN 0 is now reserved and ready to begin a new CLI session.
 - If the Diamond-VT configuration is reserved by a different CLI session (i.e. serial or Telnet), the in-band session is not allowed to modify the Diamond-VT configuration. If you try, the results buffer of LUN 0 returns:

Process X has the configuration reserved.

ID of this session = Y

Ready.

- 2 The initiator issues a SCSI Write Buffer command to LUN 0. A Write Buffer command must be accompanied by an ASCII buffer representing the CLI command string such as

set DiamondName Omega1

LUN 0 executes the command line and create feedback in the form of ASCII characters into a buffer. This buffer is 8 KB and circular. Retrieve the results by issuing a **Read Buffer** command before issuing another **Write Buffer** command.

- 3 A subsequent **Write Buffer** command executes the new command line and overwrites the previous results in the buffer with new results.
- 4 LUN 0 can be released by issuing a **SCSI Release** command to the LUN after each Write/Read Buffer pair, or multiple Write/Read Buffer pairs.

Initiator (Host)	Diamond-VT
Reserve LUN 0	return: "ok"
Write Buffer LUN 0 bid 'AA' "get Temperature"	executes the CLI command, stores output in buffer
Read Buffer LUN 0 bid 'AA'	return:"Temperature=28 C\r\nReady.\r\n0"
Release LUN 0	return: "ok"

I/O details

The buffer sent to the Services LUN during the data out phase of a Write Buffer command must be:

- ASCII data
- maximum 80 bytes length
- terminated with either a carriage return character (0x0D), line feed character (0x0A) or NULL character (0x00)
- Characters following the first carriage return character, line feed character or NULL character are ignored.

The buffer retrieved from the Services LUN during the data-in phase of a **Read Buffer** command:

- ASCII data
- 8 KBytes (8192 bytes) in length
- terminated with a NULL character (0x00)
- Characters following the NULL character are meaningless.

A **CHECK_CONDITION**, **INVALID_PARAMETER_IN_CDB** is returned

to an initiator that specifies an incorrect Buffer ID, Mode, Length or Buffer Offset. The Mode is

always Data (0x2), the Buffer ID is always 0 and the Buffer Offset is always 0.

Exhibit 4.1-2 The SCSI command process: reserve the Diamond-VT, send the command, release the Diamond-VT.

Initiator/Host	Diamond-VT
Goal: reserve the Diamond-VT for an in-band CLI command SCSI cdb: Reserve LUN 0	=> <= SCSI success
Goal: retrieve the Diamond-VT temperature via in-band CLI 1. Issue the command: SCSI cdb: WriteBuffer LUN 0, bid='AA', "get Temperature\n"	=> places "Temperature=28C\n\r" into the read-data buffer <= SCSI success
2. Retrieve the results: SCSI cdb: ReadBuffer LUN 0, bid='AA'	=> <= Returns "Temperature=28C\n\r" from the read-data buffer <= SCSI success
Goal: release the Diamond-VT for other in-band users SCSI cdb: Release LUN 0	=> <= SCSI success

4.2 Serial Port Access

The Diamond-VT provides remote service operations over the RS-232 serial port using standard terminal emulation software available with most systems.

The Diamond-VT supports service operations over the RS-232 serial port using standard terminal emulation software available with most systems.

- 1 Connect a DB-9 null modem serial cable between the port marked RS-232 on the front of the Diamond-VT and one of the computer's serial ports. A gender changer or DB-9 to DB-25 converter may be needed depending on the cables you are using. The cable must be no longer than three meters.
- 2 Boot the computer used to manage the Diamond-VT.
- 3 Start a terminal emulator program such as Windows HyperTerminal. Set the emulator to use the COM port with cable attached, then the following settings
 - 115200 baud
 - 8 bit ASCII
 - no parity
 - ASCII terminal type
 - 1 stop bit
 - flow control none
 - echo typed characters locally
- 4 Turn on the Diamond-VT. Upon successful power on and diagnostics, the unit should display the POST (power on self test) information found in Exhibit 4.0-1 on page 16.
- 5 You should now be in the Command Line Interface mode. To see a list of available commands, type **help** at the **Ready** prompt or refer to this manual's Index.
- 6 Use the Command Line Interface to configure the unit as a RAID Level 10 or RAID Level 5 array with zones and/or Hot Spare sleds as described later in this manual.

4.3 Ethernet Access: Telnet and SNMP Protocols

The optional 10/100 BaseT Ethernet port provides Telnet- or SNMP-based monitoring and management.

The 10/100 Base T Ethernet management services card provides Telnet-based monitoring and management, including firmware update using FTP.

Remote system monitoring is also available using Simple Network Management Protocol (SNMP). An agent resides in the Diamond-VT which takes information from the Array and translates it into a form compatible with SNMP. If certain conditions arise, the agent sends asynchronous notifications (traps) to a client.

To connect to the Ethernet port

- 1 Connect a cross-over cable (for a direct connection to a PC) or regular network cable from a network device to the optional RJ45 Ethernet port on the Ethernet management card on the front of the Diamond-VT.
- 2 If using a direct connection, power on and boot up the host computer.
- 3 Attach a DB-9 null modem serial cable (the cable must be no longer than three meters) from the RS-232 port of the Diamond Array to a host computer and open a terminal emulator program on the host to set the Ethernet parameters. Turn on the Diamond-VT.
- 4 *First time use:* Upon successful power up and diagnostics, set the host computer with the appropriate settings.

The host computer must have appropriate network settings to allow it to communicate with the Diamond-VT. Please see your system administrator for more information.

To use Telnet

- 1 If you have not already done so, change the IP address from the default by first accessing the serial connection and using the CLI. You may change the IP address to a network specific value or, if the local network uses DHCP, you may enable automatic IP addressing (**set IPDHCP enabled**) using the CLI.
- 2 Open a Telnet session on the host computer.

- IP address
- Port type: telnet
- Terminal type: vt100

- 3 If you make any changes to the network setting on the Diamond Array, use the **SaveConfiguration Restart** command.
- 4 Username/password: You are prompted for a username and password, up to eight characters each, case insensitive. Only one username/password combination is available per Diamond-VT.
 - You may change the telnet username and/or password after entering a CLI session using the commands

```
set TelnetUsername [username]
set TelnetPassword [password]
• Or you may change the telnet username and/or password using the Configuration page of the ExpressNAV interface.
```

- The default username is **telnet** and default password is **diamond**.
- 5 In the Command Line Interface mode, see a list of available commands by typing **help** at the **Ready** prompt or refer to *Summary of CLI Commands* on page 29.
- 6 Using the ExpressNAV interface, configure the unit as RAID Level 10 or RAID Level 5 with zones and/or Hot Spare sleds as described later in the manual.

To use SNMP

- 1 Enter the Command Line Interface through the serial port or Ethernet.
- 2 Change the IP address to a network specific value or, if the local network uses DHCP, enable automatic IP addressing.
- 3 Set the number of trap client addresses by typing **set SNMPTrapAddress [1-6] [IPAddress] [Level]**
- 4 Type **set SNMPUpdates enabled**.
- 5 Type **set SNMPTraps enabled**.
- 6 Type **SaveConfiguration restart** to reboot the Diamond-VT.
- 7 Install SNMP management software on each client you wish to receive traps (messages).

- 8 Call technical support (see *Warranty* in the Appendix, page xv) to get the appropriate MIB file for your Diamond-VT.
- 9 For each client, copy the MIB file to the directory containing the SNMP management software.
- 10 From within the SNMP management software, compile the file **attodmnd-mib.mib** according to the software's procedures.
- 11 Unload any default MIBs.
- 12 Load the Diamond MIB **ATTODIAMOND**.
- 13 When requested, enter the Diamond-VT IP address as the Remote SNMP Agent.
- 14 The SNMP management software contacts the agent in the Diamond-VT. The screen displays system information.
- 15 Status is monitored and reported through the SNMP management software.

Traps are generated for the following situations:

- Temperature status changes in any of the sensors located on the Diamond-VT mid-plane.
- A drive or a sled is physically removed from the Array or put into the Array.
- The power supply is turned on or off.
- The fan is physically stopped.

5.0 ATTO ExpressNAV: Browser-based Interface

The easiest way to communicate with the Diamond Storage Array is to use ATTO ExpressNAV, a user-friendly GUI interface accessed through a browser to control the most common capabilities of the array.

Access ATTO ExpressNAV from any browser that supports the latest standards for XHTML 1.0 and CSS1. To take full advantage of the ExpressNAV interface you should have Java script enabled through your browser.

Browser compatibility

All pages are written in pure XHTML 1.0 and CSS1 to be compatible with the latest versions of Internet Explorer, Netscape, Mozilla (including K-Meleon, Camino, Mozilla Firefox, Epiphany and Galeon), and KHTML (including Konqueror and Safari).

Minimum requirement is for Internet Explorer 5.5 and Netscape 6.2.

To optimize ExpressNAV in Internet Explorer

- 1 Go to the browser toolbar and click on **Tools**
- 2 Click on **Internet Options**
- 3 Click on the **Security** tab
- 4 Click on the **Custom Level** button.
- 5 Click on **Microsoft VM, Java permissions**
- 6 Ensure **Disable Java** is not selected.
- 7 Click on the **Miscellaneous** tab.
- 8 Click on **Metarefresh**

Opening an ExpressNAV session

- 1 Obtain the IP address of the array.
- 2 Type the IP address of the array into the browser address window.
- 3 The ExpressNAV interface splash screen is displayed. Click on **Enter**.
- 4 Enter the username and password set previously in *ATTO ExpressNAV: Browser-based Interface* on page 23.

- The default username is **Diamond**
- The default password is **Password**

- 5 The product faceplate display appears. Click the component you want to manage on the left-hand side menu or go to the Advanced screen to use the CLI.

Navigating ExpressNAV

All pages are accessible by clicking on their titles on the left side of the page. You may also go back one page or go to the **Home** page via the titles on the left side of the page.

Clicking on any of the red option names will bring up a help window. After making changes on a page, click the **Submit** button at the bottom. Clicking this button is equivalent to typing in all the CLI commands and then the command `saveconfiguration norestart`.

Exhibit 5.0-3 Navigating ATTO ExpressNAV screens

Information required to perform changes

ATTO Diamond™ VT

RAID Configuration

Info for Virtual Device 59

Type	VDID	#Parts	State	Capacity	Interleave
RAID5	59	8	DEGRADED	305161MB	128

Set Rebuild State

Sled	Rebuild State
1	<input type="radio"/> ok <input checked="" type="radio"/> degraded <input type="radio"/> faulted <input type="radio"/> halted
2	<input type="radio"/> ok <input checked="" type="radio"/> degraded <input type="radio"/> faulted <input type="radio"/> halted
3	<input type="radio"/> ok <input checked="" type="radio"/> degraded <input type="radio"/> faulted <input type="radio"/> halted

options

Options

Interleave: 128
 enabled disabled

Parameter name
Red print provides link to help text

Auto Rebuild:

Submit button
same as typing all CLI commands and `saveconfiguration norestart`

Reset button
return to previous setting without making any changes

5.1 ExpressNAV Pages

Each page in the ATTO ExpressNAV interface provides information and/or configuration parameters based on specific topics. Each page can be reached through the menu on the left hand side of each page.

Status

General information:

- Unit Information including Vendor ID, Product ID, Firmware Revision and Serial Number
- Environmental information
- World Wide Identifiers including Node Names and Port Names
- Host Interface Card Status
- Fan Status
- Power Supply Status
- Storage Status including ATA Disk Errors and Logical Unit Conflicts

Ethernet

Configures the Ethernet port. Configurable parameters are:

- IP Address
- IP Gateway
- IP Subnet Mask
- Ethernet Speed
 - Use DHCP

See *Ethernet Access: Telnet and SNMP Protocols* on page 21 for details.

SNMP

Remote system monitoring is available using Simple Network Management Protocol (SNMP).

See *Ethernet Commands* on page 33 for details on each parameter.

Serial Port

Allows you to configure the serial port. Configurable options are Baud Rate and Echo

See *Ethernet Access: Telnet and SNMP Protocols* on page 21 for more information.

Fibre Channel

Manages the Fibre Channel port.

- Data rate
- Full duplex mode
- Connection mode

See *Connecting a Fibre Channel Array* on page 11 for more information.

Storage Management

Displays information about the drives and their status including

- Sled Number
- Capacity of each sled
- Number of errors
- Type of configuration (RAID level)
- Virtual Disk ID

You may place sleds on or off line by selecting or de-selecting a check box.

See *Drive Management Commands* on page 41 for more information.

Once you open this page, other configuration pages are available on the menu on the left hand side of the page.

RAID

Configures RAID groups. Information provided includes

- Type of configuration (RAID level)
- Virtual Disk ID
- Number of partitions
- State of sleds
- Capacity of sleds
- Interleave values

Configurable options are:

- RAID Level
- Number of tape volumes
- Number of tape drives
- Hot Spare sleds

From the **RAID** page, go to **RAID Rebuild**

Configuration to change

- Interleave
- Rebuild state
- Enable/disable auto rebuild

See *Configuring the Diamond-VT* on page 47 for more information.

Clear Data

- view the status of any **Clear Data** command
- view the rebuild state of each sled
- initiate a RAID Level 5 **Clear Data** command

See *Drive Management Commands* on page 41 for more information.

Logical Units

Displays information on the logical units which have been configured and allows you to change the status from online or offline or degraded.

Partitions

Displays the current configuration of the Diamond-VT including

- Partition ID
- Virtual Drive ID
- LUN
- Capacity of each partition

See *Drive Management Commands* on page 41 for more information.

Zoning

Displays the current configuration of the Diamond-VT. Changes may be made.

See *Zones* on page 51 for more information.

Tape Volumes

Displays the Volume ID and capacity, capacity used and capacity remaining of tape volumes.

You may also Write Protect a Virtual Tape Volume.

See *Configuring the Diamond-VT* on page 47 for more information.

Tape Drives

Sets up Virtual Tape configurations and displays the LUN, state, partition ID, Virtual Disk ID, Tape Volume ID and the capacity and usage percentage of all the tape drives.

See *Configuring the Diamond-VT* on page 47 for more information.

Move Medium

Manually move the available tape volumes in or out of a tape drive by dragging and dropping a tape volume icon onto one of the tape drive icons.

Rebuild

Displays the current status of rebuilds and allows you to halt, resume or initiate rebuilds.

See *Drive Management Commands* on page 41 for more information.

Configuration

Manages with configurable options

- User name
- Password

- Minimum operating temperature
- Maximum operating temperature
- Identify Diamond
- Restore defaults

Refer to *Maintenance Services Commands* on page 38 for details.

Advanced

Input any CLI command available through the Diamond-VT while in ExpressNAV

To use the advanced page CLI commands

- 1 After the page opens and the **Ready** prompt appears, type in the CLI command
- 2 Click the **Submit** button, the equivalent of typing the CLI command into a telnet or serial port CLI session. A text field beneath the box lists the most recent commands issued to the Diamond-VT.
- 3 Type **SaveConfiguration norestart**
- 4 Click the **Submit** button. Your changes are implemented.
- 5 To keep the changes through the next power cycle, type **FirmwareRestart** or go to the **Restart** page and click **Restart**.

Restart

Allows you to implement a firmware restart of the Diamond-VT. Access is via the **Restart** link on the left side of the page.



Note

Restarting the firmware may take a few minutes.

- 1 Click the **Restart** button. A box asks you to wait until the counter gets to 0 and then the browser refreshes.
- 2 If the browser does not refresh after the counter gets to 0, click the link to refresh it manually.

Help

Gives help information about the command line interface commands and troubleshooting tips. This page provides links to pages with help text for each category of options and one link to the

Troubleshooting Tips and **FAQs** page on the ATTO website. Contact information for getting in touch with ATTO technical support is on the right.

When you click a red text box on any page, ExpressNAV asks for your login information, then open a dialog box with help text.

6.0 CLI: Interface via ASCII-based Commands

The command line interface (CLI) provides access to Diamond-VT services through a set of ASCII-based commands. CLI commands may be entered while in CLI mode or by accessing the Advanced CLI Configuration page in the ExpressNAV interface.

- CLI commands are context sensitive and generally follow a standard format:

[Get | Set] Command [Parameter1 | Parameter2]

followed by the **return** or **enter** key

- CLI commands are not case sensitive: you may type all upper or all lower case or a mixture, no matter what the definition either in **help** or these pages states. Upper and lower case in this manual and the help screen are for clarification only.
- Commands generally have three types of operation: get, set and immediate as summarized in Exhibit 6.0-1.

The get form returns the value of a parameter or setting and is an informational command.

Responses to get commands are specified in the Results field for each command, followed by **Ready**.

The set form is an action that changes the value of a parameter or configuration setting. It may require a **SaveConfiguration** command and a system restart before changes are implemented. The restart can be accomplished as part of the

SaveConfiguration command or by using a separate **FirmwareRestart** command. A number of set commands may be issued before the **SaveConfiguration** command.

Responses to set commands are either an error message or **Ready**. *, which indicates a **SaveConfiguration** command is required.

Set commands which do not require a **SaveConfiguration** command, defined as immediate commands, are immediately implemented.

Responses to immediate commands are either an error message or **Ready**.



Note

Zone commands do not use the get, set forms. See Zones on page 51 for more information on how to use Zone commands.

Symbols, typefaces and abbreviations used to indicate functions and elements of the command line interface used in this manual include those found in Exhibit 6.0-2.

Exhibit 6.0-1 Command Line Interface actions and responses

Set commands configure the Diamond-VT and display what you have changed after completing the task. Commands which require a **SaveConfiguration** command to complete their implementation will return **Ready**. *. **Set** commands which do not require a **SaveConfiguration** command are immediately implemented.

Get commands display information about the configuration of the Diamond-VT. Responses to **get** commands are specified in the Results field for each command, followed by **Ready**.

Screen messages, also called returns, may be either terse, with just the current information, or verbose, with labels and the current information. Default is verbose. If you want the terse mode, type **set VerboseMode disabled**.

Exhibit 6.0-2 Symbols, typefaces and abbreviations used to indicate functions and elements of the Command Line Interface

Symbol	Indicates
[]	Required entry
< >	Optional entry
	pick one of
...	Ellipses, repetition of preceding item
\n	end of line
-	a range (6 – 9 = 6, 7, 8, 9)
Boldface words	must be typed as they appear
<i>Italicized words</i>	Arguments which must be replaced by whatever they represent
Fp	Fibre Channel port number (0 <= fp <= 1)
Fl	Fibre Channel LUN (0 <= fl <= 24), where 0 represents the Diamond-VT unit, and 1-24 represent the disk drives.
device_lun	The LUN of the RAID drive (used in zoning)
host_name	In a Fibre Channel environment, the WWPN (World Wide Port Name); in a SCSI environment, SCSI Initiator ID (used in zoning)
port_number	The Diamond port number (0, 1) for the data path (used in zoning)
zone_name	Alphanumeric or ‘_’, character string less than or equal to 16 characters long (used in zoning)

Exhibit 6.0-3 CLI commands returns may be terse (short) or verbose (with parameter names and details of results). Zoning command returns follow these patterns:

return type/mode	return format/content
errors	context sensitive error message\n ERROR message\n
command completion	Ready.\n
single line output	shows the line
multiple line output	shows the line count followed by the output lines

6.1 Summary of CLI Commands

A summary of the Command Line Interface commands, their defaults, an example of how they might be used, and where you can find the specifics of the command. Commands which have no default values associated with them have a blank entry in that column of the table.

Command	Defaults	Example	Page
ATADiskState	Online	set AtaDiskState 6 1 offline	41
AudibleAlarm	Disabled	set AudibleAlarm disabled	39
AutoRebuild	Disabled	set AutoRebuild enabled	41
ClearDiskReservedArea		ClearDiskReservedArea 8 2	41
DiamondModel	Diamond	get DiamondModel	39
DiamondName	“ ”	get DiamondName	39
DriveCopy		DriveCopy 1 1 2 2	41
DriveCopyHalt		DriveCopyHalt 2 2	41
DriveCopyResume		DriveCopyResume 2 2	41
DriveCopyStatus		DriveCopyStatus	39
DriveInfo		DriveInfo 3 2	39
DriveSledPower	On	set DriveSledPower 9 1 off	41
DriveWipe		DriveWipe 2 2	42
ECC	Enabled	set ECC disabled	42
EthernetSpeed	Auto	set EthernetSpeed 100	33
Exit		exit	33
FcConnMode	Loop	get FcConnMode	35
FcDataRate	Auto	set FcDataRate 2 gigabit	35
FcFairArb	Enabled	get FcFairArb	35
FcFrameLength	2048	get FcFrameLength	35
FcFullDuplex	Enabled	set FcFullDuplex enabled	35
FcHard	Disabled	get FcHard	35
FcHardAddress	0x03, 0x04	get FcHardAddress 0	35
FcNodeName		get FcNodeName	39
FcPortInfo		get FcPortInfo	35
FcPortList		FcPortList	36
FcPortName		get FcPortName 1	39
FcSCSIBusyStatus	Busy	set FcSCSIStatus qfull	36
FcWWName		get FcWWName 0	36
FirmwareRestart		FirmwareRestart	32
FTPPassword	diamond	set FTPPassword barbw52	33
Help		Help DriveInfo	32
IdentifyDiamond	Disabled	get IdentifyDiamond	39
ldeTransferRate	4	set ldeTransferRate 4	42

Command	Defaults	Example	Page
ldeWriteCache	enabled	set idewritecache disabled	42
Info		Info	39
InquiryData		InquiryData 11456 124345 1.0 11242 14564 2	42
IPAddress	10.0.0.1	set ipaddress 19.172.2.2	33
IPDHCP	Disabled	set ipdhcp enabled	33
IPGateway	0.0.0.0	get ipgateway	33
IPSubnetMask	255.255.255.0	get IPSubnetMask	33
LUNInfo		LUNInfo 1	39
LUNState	Online	get LunState 1	42
MaxEnclTempAlrm	47	get MaxEnclTempAlrm	38
MediumType	0x85	get MediumType	42
MinEnclTempAlrm	5	set MinEnclTempAlrm 10	38
PartitionInfo		partitionInfo	39
PowerAudibleAlarm		poweraudiblealarm disabled	40
QuickTape		set QuickTape RAID5 15 1 enabled	42
RAID5ClearData		RAID5ClearData	43
RAID5ClearDataStatus		RAID5ClearDataStatus	40
RAIDHaltRebuild		RAIDHaltRebuild 3	43
RAIDInterleave	128	get RAIDInterleave	43
RAIDManualRebuild		RAIDManualRebuild 2 3	43
RAIDRebuildState		set RAIDRebuildState 2 OK	40
RAIDRebuildStatus		get RAIDRebuildStatus	40
RAIDResumeRebuild		RAIDResumeRebuild 5	43
RebuildPriority	same	set RebuildPriority high	44
ResolveLUNConflicts		resolvelunconflicts	44
RestoreConfiguration		RestoreConfiguration default	32
RestoreModePages		RestoreModePages	44
SaveConfiguration		SaveConfiguration restart	32
SerialNumber		get SerialNumber	40
SerialPortBaudRate	115200	set SerialPortBaudRate 9600	37
SerialPortEcho	Disabled	get SerialPortEcho	37
SerialPortHandshake	None	get SerialPortHandshake	37
SerialPortStopBits	1	set SerialPortStopBits 1	37
SledFaultLED		set SledFaultLED 9 on	40
SMARTData		SMARTData 2 1	40
SNMPTrapAddress	10.0.0.1	get snmptrapaddress	33
SNMPTraps	Disabled	get snmptraps	34
SNMPUpdates	Disabled	get snmpupdates	34
SpeedWrite		get speedwrite	38

Command	Defaults	Example	Page
SystemSN		get systemsn	32
TapeDriveInfo		TapeDriveInfo	40
TapeVolumeBlockSize	1	set TapeVolumeBlockSize 2	44
TapeVolumeInfo		TapeVolumeInfo	40
TapeWriteProtect	Disabled	set TapeWriteProtect enabled	44
TelnetPassword	diamond	set TelnetPassword 123ABC	33
TelnetTimeout	Disabled	set TelnetTimeout 360	34
TelnetUsername	telnet	set TelnetUsername diamond1	34
Temperature		get Temperature	40
VerboseMode	Enabled	get VerboseMode	32
VirtualDriveInfo		virtualdriveinfo active	40
Zmodem		zmodem receive	38
ZoneAddDevice		zoneadddevice zone1 2	44
ZoneAddHost		zoneaddhost zone1 20:00:00:18:86:00:98:00	44
ZoneAddPort		zoneaddport zone1 0	44
ZoneClearAll		zoneclearall	45
ZoneCommit		zonecommit	45
ZoneCreate		zonecreate zone1	45
ZoneDelete		zonedelete zone1	45
ZoneInfo		zoneinfo	40
ZoneRemoveDevice		zoneremovedevice zone1 1	45
ZoneRemoveHost		zoneremovehost zone1 20:00:00:18:86:00:98:00	45
ZoneRemovePort		zoneremoveport zone1 0	45
ZoneRetrieve		zoneretrieve	38
ZoneState	Disabled	ZoneState zone1 enabled	45

6.2 General Use Commands

The following commands, listed alphabetically, describe or perform general functions.

FirmwareRestart

Causes a warm restart of the Diamond Storage Array.

Immediate: FirmwareRestart

before the restart and saved will be implemented. Restart or no Restart parameter is optional

Immediate: SaveConfiguration <Restart| NoRestart>

Help

Displays a list of available commands. Type 'help' followed by a command name to display detailed command-specific information.

Immediate: Help [Command Name]

SystemSN

Stores the Diamond Storage Array serial number. The serial number may be 1-16 characters.

Set syntax: set SystemSN [n]

Requires a SaveConfiguration command

Get syntax: get SystemSN

RestoreConfiguration

Restores configuration to either the default configuration or the configuration last saved into non-volatile memory. The saved option will undo any changes made since the last save.

Immediate: RestoreConfiguration [Default|Saved]

Specifies the detail of verbal feedback for the Command Line Interface. Disabling this option removes parameter names from 'get' commands and removes descriptions from 'help' commands.

Default: enabled (returns have parameter information)

Set syntax: set VerboseMode [enabled | disabled]

Get syntax: get VerboseMode

SaveConfiguration

If the restart option is selected, the Diamond will cycle its power. The norestart option will save changes without restarting. Please note: certain modifications require a **SaveConfiguration** command and a system restart. If required, the return **Ready.** * will be displayed after the return for the modification. You may make several changes through commands and **SaveConfiguration** before implementing a restart, but once you have restarted the Diamond, all the command changes created

ZoneCommit

Commits the current Planned Zone Configuration, making it the persistent, Active configuration. To complete this procedure, the ZoneState command must be entered as enabled to activate the zone before using the ZoneCommit command.

Set syntax: ZoneCommit

6.3 Ethernet Commands

Ethernet configuration commands configure the Ethernet and TCP/IP parameters for the Diamond Storage Array with an optional Ethernet management services card.

EthernetSpeed

Specifies the speed of the Ethernet Network to which the Diamond Storage Array is connected. Choices are:
[10|100 | Auto] where 10= 10 baseT, 100= 100 baseT

Default: auto

Set syntax: set EthernetSpeed [10 | 100| Auto]

Get syntax: get EthernetSpeed

Requires a SaveConfiguration command

Returns: [10 | 100 | UNKNOWN]

If auto enabled, value in parentheses indicates current speed

Exit

Exits the current Ethernet telnet CLI session; it has no effect if used during a serial or in-band CLI session.

Immediate command: Exit

FTPPassword

Specifies a password of up to 32 characters for an FTP session.

Default: diamond

Set syntax: set FTPPassword

Requires a SaveConfiguration Restart command

IPAddress

Specifies the IP Address of the Diamond Storage Array on the Ethernet network. If DHCP is enabled, the assigned address of the Diamond will be displayed. Setting this value always modifies the internal NVRAM value of the IP address. If IPDHCP is enabled (see below), get command reports current IP address assigned by DHCP server

Default IP Address: 10.0.0.1

Set syntax: set IPAddress xxx.xxx.xxx.xxx

Get syntax: get IPAddress

Requires a SaveConfiguration command

IPDHCP

Selecting DHCP allow the Diamond Storage Array to request an IP address from the network. It requires that the Diamond be attached to a network with at least one DHCP server. The network must have at least one DHCP server.

Default: disabled

Set syntax: set IPDHCP [enabled | disabled]

Get syntax: get IPDHCP

Requires a SaveConfiguration command

IPGateway

Specifies the IP Gateway for the Diamond Storage Array on the Ethernet network. If IPDHCP is enabled (see above), get command reports current IP gateway assigned by DHCP server. Must conform to xxx.xxx.xxx.xxx standard network IP addressing.

Default: 0.0.0.0

Set syntax: set IPGateway xxx.xxx.xxx.xxx

Get syntax: get IPGateway

Requires a SaveConfiguration command

IPSubnetMask

Specifies the IP Subnet Mask for the Diamond Storage Array on the Ethernet network. If DHCP is enabled, the assigned subnet mask for the unit will be displayed. Setting this value always modifies the internal NVRAM value of the IP Subnet Mask. If IPDHCP is enabled (see above), get command reports current subnet mask assigned by DHCP server.

Default: 255.255.255.0

Set syntax: set IPSubnetMask xxx.xxx.xxx.xxx

Get syntax: get IPSubnetMask

Requires a SaveConfiguration command

SNMPTrapAddress

Sets up IP trap address and trap level.

Default: 10.0.0.1

Set syntax: set SNMPTrapAddress [Index:1-6] [Address: xxx.xxx.xxx.xxx] Level: Critical | Warning | All | None|...

Requires a SaveConfiguration Restart command

Get syntax: get SNMPTrapAddress

SNMPTraps

Enables or disables SNMP traps.

Default: disabled

Set syntax: set SNMPTraps [enabled|disabled]

Requires a SaveConfiguration Restart command

Get syntax: get SNMPTraps

SNMPUpdates

Enables or disables the SNMP Management Information Base (MIB) database.

Default: disabled

Set syntax: set SNMPTraps [enabled|disabled]

Requires a SaveConfiguration Restart command

Get syntax: get SNMPUpdates

TelnetPassword

Specifies password for telnet session. Only one username/password combination is available per Diamond Storage Array. RestoreConfiguration default sets the telnet username and password to the default values. Password is case insensitive, 1 to 8 characters.

Default: diamond

Set syntax: set TelnetPassword [password]

Get syntax: none

Requires a SaveConfiguration command

TelnetTimeout

Specifies the number of minutes of inactivity which will elapse before a telnet session automatically times out. Limits: 1-1440 minutes.

Default: disabled

Set syntax: set TelnetTimeout [1-1440 | disabled]

Get syntax: get TelnetTimeout

Requires a SaveConfiguration command

TelnetUsername

Specifies username for telnet session. Only one username/password combination is available per Diamond Storage Array. RestoreConfiguration default sets the telnet username and password to the default values. Username is case insensitive, 1 to 8 characters

Default: telnet

Set syntax: set TelnetUsername [username]

Requires a SaveConfiguration Restart command

The Telnet and SNMP protocols also use CLI commands.

TelnetUsername

Specifies username for telnet session. Only one username/password combination is available per Diamond Storage Array. RestoreConfiguration default sets the telnet username and password to the default values. Username is case insensitive, 1 to 8 characters.

Default: telnet

Set syntax: set TelnetUsername [username]

Get syntax: none

Requires a SaveConfiguration command

6.4 Fibre Channel Configuration Commands

The Fibre Channel ports are configured with default settings but may be customized to your specifications using the CLI commands in this section.

FcConnMode

Specifies the Fibre Channel topology for the Diamond Storage Array. Options are loop only (loop), point-to-point only (ptp), loop preferred (loop-ptp) or point-to-point preferred (ptp-loop). See *Connecting a Fibre Channel Array* on page 11 for more information on Fibre Channel topology. Applies to both Host Interface Cards

Default: loop

Set syntax: set FcConnMode [loop | ptp| loop-ptp| ptp-loop]

Requires a SaveConfiguration Restart command

Get syntax: get FcConnMode

FcDataRate

Specifies the Fibre Channel data rate at which the Diamond operates. Applies to both Host Interface Cards

Default: auto

Set syntax: set FcDataRate [1gb | 2gb | auto]

Requires a SaveConfiguration Restart command

Get syntax: get FcDataRate

FcFairArb

Enabling this feature causes the Diamond Storage Array to follow the arbitration fairness rules on the FC-AL. Applies to both Fibre Channel ports

Default: enabled, enabling arbitration fairness

Set syntax: set FcFairArb [enabled | disabled]

Requires a SaveConfiguration Restart command

Get syntax: get FcFairArb

FcFrameLength

Sets the frame length of a command. If not specified in the set command, current frame length is displayed.

Applies to both Fibre Channel ports

Default: 2048

Set syntax: set FcFrameLength [512 | 1024 | 2048]

Requires a SaveConfiguration Restart command

Get syntax: get FcFrameLength

FcFullDuplex

Enable to allow full duplex Fibre Channel communication between the Diamond Storage Array and

host devices. Disable FcFullDuplex causes half duplex mode. Applies to both Fibre Channel ports

Default: enabled

Set syntax: set FcFullDuplex [enabled | disabled]

Requires a SaveConfiguration Restart command

Get syntax: get FcFullDuplex

FcHard

If hard addresses are enabled, the Diamond Storage Array tries to use its internal hard address as its address on the loop. Under soft addressing, the Diamond Storage Array loop address is assigned during loop initialization. Use FcHardAddress (described below) if you enable hard addressing. Applies to both Fibre Channel ports

Default: disabled

Set syntax: set FcHard [enabled | disabled]

Requires a SaveConfiguration Restart command

Get syntax: get FcHard

FcHardAddress

This hexadecimal value represents the address the Diamond Storage Array tries to use if hard addressing is enabled. When an optional address is not present, the current value is displayed. Each port has individual hard address value

Default: 0x03 for port 0, 0x04 for port 1

Set syntax: set FcHardAddress [fp | [address]]

Requires a SaveConfiguration Restart command

Get syntax: get FcHardAddress [fp]

FcnodeName

Returns the Fibre Channel node name stored in NVRAM for this Fibre Channel port: the same as the World Wide Name for port 0.

Get syntax: get FcnodeName

FcPortInfo

Retrieves information about the current state of each Fibre Channel port. The status field indicates 'disabled' when a port has been internally disabled.

Immediate command: FcPortInfo

FcPortList

Lists the status of all available Fibre Channel ports.

Immediate command: FcPortList

FcPortName

Returns the Fibre Channel port name stored in NVRAM for this Fibre Channel port.

Get syntax: get FcPortName [port number]

FcScsiBusyStatus

Specifies the SCSI status value returned when the Diamond is unable to accept a SCSI command because of a temporary lack of resources.

Default: busy

Actions: set FcScsiBusyStatus [busy | qfull]

Requires a SaveConfiguration Restart command

Get syntax: get FcScsiBusyStatus

FcWWName

Sets or view the Word Wide Name (WWPN) of the referenced Fibre Channel port. The WWPN is a unique 8-byte number that identifies the port on a Fibre Channel network. Only the three least significant bytes of the WWPN can be modified. Fabric and loop operations are unpredictable if duplicate WWNs are assigned.

Default: 20 00 0x where x is for 0 for port 0, 1 for port 1

Set syntax: set FcWWName [PortNumber [0 | 1]

Requires a SaveConfiguration Restart command

Get syntax: get FcWWName [PortNumber [0 | 1]

6.5 Serial Port Configuration Commands

The serial port configuration may be customized by using the following commands:

SerialPortBaudRate

Sets the baud rate the Diamond Storage Array uses for its terminal interface. Choices are 2400, 9600, 19200, 38400, 57600, 115200.

Default: 115200

Set syntax: set SerialPortBaudRate [2400 | 9600 | 19200 | 38400 | 57600 | 115200]

Get syntax: get SerialPortBaudRate

SerialPortEcho

Controls whether the Diamond Storage Array echoes characters on its RS-232 port. Local ASCII terminal (or terminal emulator) echo settings should be set to disabled while in serialportecho enabled

Default: disabled

Set syntax: set SerialPortEcho [enabled | disabled]

Requires a SaveConfiguration Restart command

Get syntax: get SerialPortEcho

SerialPortHandshake

Describes which handshaking method the Diamond Storage Array uses for its terminal interface (hardware, Xon/Xoff or none). Choices are hardware, Xon or none

Default: none

Set syntax: set SerialPortHandshake [hard| Xon| none]

Requires a SaveConfiguration Restart command

Get syntax: get SerialPortHandshake

SerialPortStopBits

Configures/reports the number of stop bits per character for the Diamond Storage Array RS -232 serial port. The number of data bits per character is fixed at 8 with no parity. Choices are 1 or 2 stop bits

Default: 1

Set syntax: set SerialPortStopBits [1 | 2]

Requires a SaveConfiguration Restart command

Get syntax: get SerialPortStopBits

6.6 Maintenance Services Commands

Maintenance commands allow updating and maintenance of the Diamond-VT.

FcScsiBusyStatus

You may set the Diamond to report busy or queue full when it is unable to accept a command.

Default: Busy

Set syntax: set FcScsiBusyStatus [busy|qfull]

FirmwareRestart

Causes a warm restart of the Diamond Storage Array

Immediate command: FirmwareRestart

MaxEnclTempAlrm

Sets/displays the maximum enclosure temperature alarm of the Diamond Storage Array in degrees Celsius. Valid entries are between 5 and 52 degrees and above the current minimum enclosure temperature alarm

Default: 47

Set syntax: set MaxEnclTempAlrm [5-52]

Requires a SaveConfiguration command

Get syntax: get MaxEnclTempAlrm

MinEnclTempAlrm

Sets/displays the minimum enclosure temperature alarm of the Diamond Storage Array in degrees Celsius. Valid entries are between 5 and 47 degrees and below the current maximum enclosure temperature alarm

Default: 5

Set syntax: set MinEnclTempAlrm [5-47]

Requires a SaveConfiguration command

Get syntax: get MinEnclTempAlrm

ResolveLUNConflicts

Re-numbers any conflicting Logical Unit numbers that exist in the Diamond. Conflicts may occur when a unit is taken from one Array and inserted into another Array.

Immediate command: ResolveLUNConflicts

RestoreConfiguration

Restores configuration to either the default configuration or the configuration last saved into non-volatile memory. The saved option will undo any changes made since the last save.

Immediate: RestoreConfiguration [Default|Saved]

SaveConfiguration

If the restart option is selected, the Diamond will cycle its power. The norestart option will save changes without restarting. Please note: certain modifications require a

SaveConfiguration command and a system restart. If required, the return **Ready.** * will be displayed after the return for the modification. You may make several changes through commands and **SaveConfiguration** before implementing a restart, but once you have restarted the Diamond, all the command changes created before the restart and saved will be implemented.

Restart or no Restart parameter is optional

Immediate: SaveConfiguration <Restart| NoRestart>

SpeedWrite

SpeedWrite is a method to improve the performance of FCP WRITE commands to SCSI devices attached to the array.

Default: disabled

Set syntax: set SpeedWrite [enabled | disabled]

Requires a SaveConfiguration Restart command

Get syntax: get SpeedWrite

Temperature

Returns the current internal temperature of this Diamond Storage Array in degrees Celsius. The value is read only.

Get syntax: get Temperature

Zmodem

Use the Zmodem protocol to transfer a file to or from the Diamond Storage Array. The filename is required if the ‘send’ option is specified. Available only through the RS-232 interface



CAUTION

After a firmware image is downloaded to the Diamond Storage Array, the image is placed into flash memory. During this time (about 90 seconds), DO NOT remove power to the Diamond Storage Array or the flash may become corrupted. Power should not be removed until the READY prompt appears.

Immediate command: Zmodem [Send filename|Receive]

ZoneRetrieve

Retrieves the Active Zone Configuration into the Planned Zone Configuration to allow modifications of the current configuration.

Zone syntax: ZoneRetrieve

6.7 Diagnostic Commands

Diagnostic commands provide information or diagnostic tools for Fibre Channel, SCSI and Serial port configurations, Diamond Storage Array settings and the status of various commands which affect the ATA drives.

AudibleAlarm

Enables or disables the audible alarm in the Diamond Storage Array. When enabled, an alarm sounds when the Fault LED on the front panel blinks.

Default: disabled

Set syntax: set AudibleAlarm [enabled | disabled]

Get syntax: get AudibleAlarm

DiamondModel

Returns specific Diamond Storage Array model information including firmware release and date.

Get syntax: get DiamondModel

DiamondName

Used to identify this Diamond over its Fibre Channel and Ethernet networks. You may customize the name of each Diamond Storage Array enclosure to distinguish it from other units. Maximum eight characters.

Set syntax: set DiamondName [name]

Requires a SaveConfiguration command

Get syntax: get DiamondName

DriveCopyStatus

Displays the status of a DriveCopy, DriveWipe or RAID5ClearData operation

Immediate command: DriveCopyStatus

DriveInfo

Displays information about all disk drives or detailed information about a specific disk drive. Detailed information about an individual drive is obtained by supplying a drive identifier. VD ID is Virtual Disk ID.

Get syntax: DriveInfo [sled ID] [drive ID]

FcNodeName

Returns the Fibre Channel node name stored in NVRAM for this Fibre Channel port: the same as the World Wide Name for port 0.

Get syntax: get FcNodeName

FcPortInfo

Retrieves information about the current state of each Fibre Channel port. The status field indicates 'disabled' when a port has been internally disabled.

Immediate command: FcPortInfo

FcPortList

Lists the status of all available Fibre Channel ports.

Immediate command: FcPortList

FcPortName

Returns the Fibre Channel port name stored in NVRAM for this Fibre Channel port.

Get syntax: get FcPortName [port number]

Help

Displays a list of available commands. Type 'help' followed by a command name to display detailed command-specific information.

Get syntax: Help [Command Name]

IdentifyDiamond

Enable this option to identify the current Diamond Storage Array. The fault LED on its front panel blinks. Disable to cancel the 'blink code.'

Set syntax: set IdentifyDiamond [enabled|disabled]

Get syntax: get IdentifyDiamond

Info

Displays version numbers and other key information about the Diamond Storage Array including data rate, connection mode, WorldWideName, Diamond Storage Array name.

Immediate command: Info [all]

LUNInfo

Displays information about all LUNs (logical unit numbers) or detailed information about a specific LUN. Do not specify a LUN to get information about all LUNs. Specify a LUN to get detailed information about that individual LUN.

Get syntax: get LUNInfo [LUN]

PartitionInfo

Displays Partition information for the selected partitions or all partitions.

Get syntax: PartitionInfo [active|planned] [Virtual Drive ID] [Partition ID]

PowerAudibleAlarm

Silences the audible alarm for a current power supply failure. The alarm will be activated on the next power failure.

Immediate command: PowerAudibleAlarm disabled

RAID5ClearDataStatus

Displays the status of RAID5 Clear Data processing. S represents the sled number, D represents the drive number. Applies to RAID5 only

Set syntax: RAID5ClearDataStatus

RAIDRebuildStatus

Displays the RAID1, RAID 5 or RAID 10 Rebuild Status Summary. If no RAID groups are defined, the header information is displayed with no data. The status summary contains the RAID1, RAID 5 or RAID 10. The RAIDRebuildStatus command has no effect on the state of any rebuild in progress.

Member index and the following fields in tabular form:

- Status : OK, DEGRADED, IN PROGRESS, or FAULTED
- Sled Number : Location of the sled
- Current LBA: Logical block currently being rebuilt
- Maximum LBA: Last logical block to be rebuilt
- Status OK: the RAID1 Mirror is in sync and no rebuild activity is occurring. The Current LBA, Maximum LBA and percentage complete values are not displayed.
- Status Degraded: the RAID1 Mirror is out of sync and is waiting to be rebuilt.
- Status In Progress: the RAID1 Mirror is out of sync and a rebuild is occurring on the respective drive.
- Status Faulted: the RAID1 Mirror is out of sync and an error occurred in an attempt to synchronize the drives in the RAID 1 group.

SerialNumber

View the board serial number, a 10-character field. The first four alphanumeric characters are an abbreviation representing the product name. The remaining six digits are the individual unit's number.

Get syntax: get SerialNumber

SledFaultLED

Changes the state of the selected sled LED to the indicated state. Choose the sled number, 1-12, or all, turn on or off

Default: off

Set syntax: set SledFaultLED [all | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |10 |11| 12] [on | off]

SMARTData

Displays the current SMART (Self-Monitoring Analysis and Reporting Technology) data for the specified drive.

Immediate command: SMARTData [sled#] [drive #]

TapeDriveInfo

Displays information about the named Tape Drive including LUN, Tape Volume ID and state of the tape drive.

Get syntax: TapeDriveInfo [tape drive #]

TapeVolumeInfo

Displays information about the named Tape Volume including Volume ID, LUN, Virtual Disk ID, Partition ID, Total capacity and percentage of capacity used.

Get syntax: TapeVolumeInfo [tape volume #]

Temperature

Returns the current internal temperature of this Diamond Storage Array in degrees Celsius. The value is read only.

Get syntax: get Temperature

VirtualDriveInfo

Displays the named Virtual Drive definitions.

Get syntax: VirtualDriveInfo [active|planned] [Virtual Drive ID]

ZoneInfo

Displays the named zones' definitions. Information about the Active Zone Configuration is the default; if you want information about the Planned Zone Configuration, type ZoneInfo Planned zone_name.

Zone syntax: ZoneInfo [Planned] [zone_name] [all]

ZoneState

Changes the specific state of a zone. The ZoneState command must be entered as enabled to activate the zone before using the ZoneCommit command (which makes the Planned Zone Configuration the Active configuration).

Default: disabled

Set syntax: ZoneState zone_name [enabled|disabled]

Get syntax: ZoneInfo

6.8 Drive Management Commands

The Diamond Storage Array ATA drives may be monitored or configured through the CLI using the commands listed below.

ATADiskState

Sets the ATA disk to the specified state. Enter the sled number (1-12), drive number (1-2) and online or offline



CAUTION

In a Hot Spare configuration, a drive sled should only be taken offline if there is absolutely no activity on that drive. If there is any activity, the rebuild of the Hot Spare sled may be flawed.

Default: online

Set syntax: set AtaDiskState [sled number] [drive number] [online] offline]

Get syntax: get AtaDiskState [sled number] [drive number]

AutoRebuild

If enabled, initiates an automatic rebuild of a “degraded” RAID group when a sled is replaced by a new sled. If disabled, you must manually rebuild the RAID configuration for the new sled by using RAIDManualRebuild.

Default: disabled

Set syntax: set AutoRebuild [enabled|disabled]

Requires a SaveConfiguration Restart command

Get syntax: get AutoRebuild

ClearDiskReservedAreaData

Clears the data in the disk’s reserved area. Restarting the Diamond Storage Array is required for these settings to take effect. Omitting ReservedAreaIndex clears the entire reserved area. Enter the sled number (1-12) and drive number (1-2).

Immediate command: ClearDiskReservedAreaData [sled number] [drive number]

DriveCopy

Copies a drive from the source disk to the destination disk. Parameters are the sled and drive numbers of the source and destination drives. The destination drive must be offline: use the ATADiskState command to determine if the disks are offline. If you choose the same source and destination drive, this command performs a DriveWipe.

Set syntax: DriveCopy [Source Sled] [Source Drive] [Destination Sled] [Destination Drive]

Get syntax: DriveCopyStatus

DriveCopyHalt

Stops a DriveCopy operation in progress.

Set syntax: DriveCopyHalt [Destination Sled] [Destination Drive]

Get syntax: DriveCopyStatus

DriveCopyResume

Resumes a DriveCopy operation that had been stopped.

Set syntax: DriveCopyResume [Destination Sled] [Destination Drive]

Get syntax: DriveCopyStatus

DriveCopyStatus

Displays the status of a DriveCopy, DriveWipe or RAID5ClearData operation

Immediate command: DriveCopyStatus

DriveInfo

Displays information about all disk drives or detailed information about a specific disk drive. Detailed information about an individual drive is obtained by supplying a drive identifier. For examples see *Diagnostic Commands* on page 39.

Get syntax: DriveInfo [sled ID] [drive ID]

DriveSledPower

Gets/sets power to the specified drive sled. Sled must be offline

Default: on

Set syntax: set DriveSledPower [sled number] [on|off]

Get syntax: get DriveSledPower [sled number]

DriveWipe

Initializes a drive: wipes it of all data. Drive must be offline

Set syntax: DriveWipe [Destination Sled] [Dest Drive]
Requires a SaveConfiguration Restart command
Get syntax: DriveCopyStatus

ECC

Specifies or displays whether ECC is enabled or not. If ECC is not available, an ECC invalid message will be returned.

Default: enabled
Set syntax: set ECC [enabled | disabled]
If enabled, SaveConfiguration Restart command required
If disabled, SaveConfiguration command required
Get syntax: get ECC

IdeTransferRate

Sets the DMA mode transfer rate for all devices. Choices are 0, 1, 2, 3, 4

Default: 4
Set syntax: set IdeTransferRate [0 | 1 | 2 | 3 | 4]
Requires a SaveConfiguration Restart command
Get syntax: get IdeTransferRate

IdeWriteCache

Sets write caching for all drives.

Default: enabled
Set syntax: set IdeWriteCache [enabled | disabled]
Requires a SaveConfiguration Restart command
Get syntax: get IdeWriteCache

InquiryData

Sets/displays the SCSI media changer (MC) & tape drive (TD) inquiry data returned by the Diamond Virtual Tape device.

MC Vendor ID: 1 - 8 chars
MC Product ID: 1 - 16 chars
MC Revision: 1 - 4 chars
TD Vendor ID: 1 - 8 chars
TD Product ID: 1 - 16 chars
TD Revision: 1 - 4 chars
Set syntax: set InquiryData [MC Vendor ID] [MC Product ID] [MC Revision] [TD Vendor ID] [TD Product ID] [TD Revision]
Requires a SaveConfiguration Restart command
Get syntax: get InquiryData

LUNInfo

Displays information about all LUNs (logical unit numbers) or detailed information about a specific LUN. Do not specify a LUN to get information about all LUNs. Specify a LUN to get detailed information about that individual LUN. For examples, see *LUNInfo* on page 39.

Get syntax: get LUNInfo [LUN]

LUNState

Sets the LUN to the specified state. May be used to facilitate removal and insertion of sleds and RAID groups during power up/power down of sleds.

Default: online
Set syntax: set LUNState [LUN number] [online|offline]
Get syntax: get LUNState [LUN number]

MediumType

Sets or displays the medium type returned by the mode pages. Use the command InquiryData to change the inquiry data displayed. Choices are

DLT/Diamond = 0x85
SDLT = 0x86
LTO = 0x00
AIT = 0x34
Default: 0x85
Set syntax: set MediumType [medium type]
Requires a SaveConfiguration Restart command
Get syntax: get MediumType

PartitionInfo

Displays Partition information for the selected partitions. See *PartitionInfo* on page 39 for examples.

Immediate command: PartitionInfo [active|planned] [Virtual Drive ID] [Partition ID]

QuickTape

Configures the Diamond-VT as a Virtual Tape device. Specify the RAID level, either RAID5 or RAID10, the number of tape volumes, enable ZoneState and specify whether Hot Spare sleds are enabled.

The system will determine the optimal number of Virtual Devices based on the number of tape volumes. Hot Spares are not available for all Virtual Tape configurations. You must designate **enabled** to allow Hot Spare sleds or **disabled** to forgo Hot Spare sleds

You may specify the first four to six alpha-numeric characters of a tape bar code, used by tape backup

software. The remaining four characters will be entered by the system automatically to identify the tape number. See *Virtual Tape* on page 49 and *Optional Hot Spare Sled* on page 50 for more information and examples.



Note

The maximum number of tape volumes and tape drives for RAID Level 5 is 30.

The maximum number of tape volumes and tape drives for RAID Level 10 is 15.

Set syntax: `set QuickTape [RAID5 | RAID10] [# tape volumes] [# tape drives] <enabled> <barcode prefix>`

Requires a SaveConfiguration command

Get syntax: `get QuickTape`

RAID5ClearData

To Zero all drives and parity to make newly created RAID5 groups ‘coherent’. The parameter ALL clears data on all RAID5 groups present in the system. Must be used at initial configuration to ensure parity is valid for all drives in the RAID Level 5 group by setting all data and parity to zero. Takes all LUNs offline automatically, then brings them online. The operation takes 3-6 hours, depending on drive capacity. Do not interrupt this process. This is a destructive operation: all information on these drives is lost. Applies to RAID5 only

Set syntax: `RAID5ClearData [ALL | LUN]`

Get syntax: `DriveCopyStatus` or `RAID5ClearDataStatus`

RAID5ClearDataStatus

Displays the status of RAID5 Clear Data processing. S represents the sled number, D represents the drive number. Applies to RAID5 only

Set syntax: `RAID5ClearDataStatus`

RAIDInterleave

Specifies the Interleave size (in 512 byte blocks) between members of a RAID group. SPAN indicates that the interleave size between drives in the group is the minimum drive size of all members in the group.

RAIDInterleave options are 16, 32, 64, 128, 256 blocks and span. Span is not available for RAID Level 5. For

RAID Level 10, choices are 16, 32, 64, 128, 256 or SPAN. For RAID Level 5, choices are: 16, 32, 64, 128, 256.

Default: 128

Set syntax: `set RAIDInterleave [1-256] [SPAN]`

Requires a SaveConfiguration Restart command

Get syntax: `get RAIDInterleave`

RAIDHaltRebuild

Stops a RAID Level 5 or 10 rebuild that is in progress.

Immediate command: `RAIDHaltRebuild [Sled Number]`

RAIDManualRebuild

Initiates a manual rebuild of a RAID Level 5 or 10 LUN. An error message is returned if the specified LUN is not a RAID Level 5 or 10 LUN or if the sled number is not available; no rebuild takes place. Applies to RAID Levels 1, 5 and 10 only

Set syntax: `RAIDManualRebuild [LUN] [Sled Number]`

RAIDRebuildState

Sets the RAID Level 5 or 10 rebuild status of the specified sled to OK, degraded or faulted.

Set syntax: `set RAIDRebuildState [Sled Number] [Degraded | OK | Faulted]`

RAIDRebuildStatus

Displays the RAID1, RAID 5 or RAID 10 Rebuild Status Summary. If no RAID groups are defined, the header information is displayed with no data. The status summary contains the RAID1, RAID 5 or RAID 10. The RAIDRebuildStatus command has no effect on the state of any rebuild in progress.

Member index and the following fields in tabular form: Status, Sled Number, Current LBA, Maximum LBA, Status.

Get syntax: `RAIDRebuildStatus`

RAIDResumeRebuild

Resumes a RAID Level 5 or 10 rebuild which had been previously stopped.

Immediate command: `RAIDResumeRebuild [Sled Number]`

RebuildPriority

Sets the priority of a RAID Level 5 or 10 rebuild. If you select High priority, rebuild I/O requests are implemented before system I/O requests. If you select Low priority, rebuild I/O requests executes only when there are no pending I/O requests. If you select Same priority, rebuild I/O and system I/O receive equal consideration.

Set syntax: set RebuildPriority [high | low | same]
Requires a SaveConfiguration Restart command
Get syntax: get RebuildPriority

ResolveLUNConflicts

Re-numbers any conflicting Logical Unit numbers that exist in the Diamond. Conflicts may occur when a unit is taken from one Array and inserted into another Array.

Immediate command: ResolveLUNConflicts

RestoreModePages

Restores all mode pages to the factory set default. Restarting the Diamond Storage Array is required for settings to take effect.

Set syntax: RestoreModePages

SledFaultLED

Changes the state of the selected sled LED to the indicated state. Enter the sled number, 1-12 or all, on or off

Default: off

Set syntax: set SledFaultLED [all|sled number] [on| off]

TapeDriveInfo

Displays information about the named Tape Drive including LUN, Tape Volume ID and state of the tape drive.

Immediate information: TapeDriveInfo [tape drive #]

TapeVolumeBlockSize

Determines the volume's block size in increments of 512-byte blocks. Setting the number of blocks to 0 will allow devices to have different upper and lower block size limits (variable block size) while setting the number of blocks to a non-zero value will limit both the upper and lower block size limits to that number (fixed block size). Choices are 0-127.

Default: 0

Set syntax: set TapeVolumeBlockSize [0 - 127]

Requires a SaveConfiguration command

Get syntax: get TapeVolumeBlockSize

TapeVolumeInfo

Displays information about the named Tape Volume including Volume ID, LUN, Virtual Disk ID, Partition ID, Total capacity and percentage of capacity used.

Get syntax: TapeVolumeInfo [tape volume #]

TapeWriteProtect

Specifies or displays the Hardware Write Protection state of the named Tape Volume.

Default: disabled

Set syntax: TapeWriteProtect [tape volume ID | all]
[enabled | disabled]

Get syntax: TapeWriteProtect [tape volume ID | all]

VirtualDriveInfo

Displays the named Virtual Drive definitions. For examples, see *Information Command Returns* on page A-iv.

Immediate command: VirtualDriveInfo [active|planned]
[Virtual Drive ID]

ZoneAddDevice

Adds one or more LUNs (devices) to an existing zone. LUNs not added to zones are not available. To complete this procedure, the ZoneState command must be entered as enabled to activate the zone before using the ZoneCommit command (which makes the Planned Zone Configuration the Active configuration).

Zone syntax: ZoneAddDevice [zone_name]
[device_LUN...]

ZoneAddHost

Adds one or more hosts to an existing zone. The host is the WWPN of the HBA attached to the system. To complete this procedure, the ZoneState command must be entered as enabled to activate the zone before using the ZoneCommit command (which makes the Planned Zone Configuration the Active configuration).

ZoneAddPort

Adds one or more ports [port_name] to an existing zone. The port refers to the specific Host Interface Card on the Diamond Storage Array, either 0 or 1. To complete this procedure, the ZoneState command must be entered as enabled to activate the zone before using the ZoneCommit command (which makes the Planned Zone Configuration the Active configuration).

Set syntax: ZoneAddPort [zone_name] [0|1]

ZoneClearAll

Removes all entries from the Planned Zone Configuration. Removes any active zones if followed immediately by a ZoneCommit command.

Set syntax: ZoneClearAll

ZoneCommit

Commits the current Planned Zone Configuration, making it the persistent, Active configuration. To complete this procedure, the ZoneState command must be entered as enabled to activate the zone before using the ZoneCommit command.

Set syntax: ZoneCommit

ZoneCreate

Creates a new named zone. Names may be up to 16 characters. To complete this procedure, the ZoneState command must be entered as enabled to activate the zone before using the ZoneCommit command (which makes the Planned Zone Configuration the Active configuration).

Set syntax: ZoneCreate zone_name

ZoneDelete

Deletes one or more named zones. To complete this procedure, the ZoneState command must be entered as enabled to activate the zone before using the ZoneCommit command (which makes the Planned Zone Configuration the Active configuration).

Set syntax: ZoneDelete [zone_name...]

ZoneInfo

Displays the named zones' definitions. Information about the Active Zone Configuration is the default; if you want information about the Planned Zone Configuration, type ZoneInfo Planned zone_name.

Get syntax: ZoneInfo

ZoneRemoveDevice

Removes one or more LUNs (devices) from an existing zone. To complete this procedure, the ZoneState

command must be entered as enabled to activate the zone before using the ZoneCommit command (which makes the Planned Zone Configuration the Active configuration).

Set syntax: ZoneRemoveDevice [zone_name] [device_LUN...]

ZoneRemoveHost

Removes one or more hosts from an existing zone. To complete this procedure, the ZoneState command must be entered as enabled to activate the zone before using the ZoneCommit command (which makes the Planned Zone Configuration the Active configuration).

Set syntax: ZoneAddHost [zone_name] [host_name...]

ZoneRemovePort

Removes one or more ports [port_name] from an existing zone. The port refers to the specific HIC, either 0 or 1. To complete this procedure, the ZoneState command must be entered as enabled to activate the zone before using the ZoneCommit command (which makes the Planned Zone Configuration the Active configuration).

Set syntax: ZoneAddPort [zone_name] [0|1]

ZoneRetrieve

Retrieves the Active Zone Configuration into the Planned Zone Configuration to allow modifications of the current configuration.

Get syntax: ZoneRetrieve

ZoneState

Changes the specific state of a zone. The ZoneState command must be entered as enabled to activate the zone before using the ZoneCommit command (which makes the Planned Zone Configuration the Active configuration).

Default: disabled

Set syntax: ZoneState zone_name [enabled|disabled]

Get syntax: ZoneInfo

Information: DriveCopyStatus

7.0 Configuring the Diamond-VT

The Diamond-VT can be configured as RAID Level 10 or RAID Level 5 with zones and/or Hot Spare sleds. Partitions are created automatically during configuration of Virtual Tape emulation. The default is a single zone which includes all LUNs (devices), all ports and all hosts. RAID is a storage configuration which uses multiple disk drives to increase capacity, performance and/or reliability.

You may configure your Diamond-VT in several different ways depending on your needs although the Diamond-VT makes some choices for you. The following elements must be considered when you are configuring your Diamond-VT:

- RAID level
- Interleave
- Number of tape volumes
- Number of tape drives
- Hot Spare sled option
- Zoning

Using the ExpressNAV browser-based interface is the easiest way to set up your Diamond-VT. You may also use the Command Line Interface commands.



CAUTION

Changing these parameters causes all previous drive data on the Diamond-VT to be erased. Make sure you back up all information before setting up a different configuration.

RAID Level 10

RAID Level 10 (mirroring with striping) increases data transfer rates while ensuring security by writing the exact same data simultaneously to two or more different drives. RAID Level 10 is used in applications requiring high performance and redundancy.

RAID Level 5

RAID Level 5 increases reliability while using fewer disks than mirroring by using parity redundancy. Distributed parity on multiple drives provides the redundancy to rebuild a failed drive from the remaining good drives. Parity data is added to the transmitted data at one end of the transaction, then the parity data is checked at the

other end to make sure the transmission has not had any errors.

In the Diamond-VT, transmitted data with the added parity data is striped across disk drives. A hardware XOR engine computes parity, thus alleviating software processing during reads and writes.

The Diamond-VT will operate in degraded mode if a drive fails unless you have Hot Spare sleds enabled (see below).

Virtual Tape Volumes

When the Diamond-VT is configured as a Virtual Tape, it is divided into several tape volumes and tape drives based on your choice and the RAID level you choose. See *Virtual Tape* on page 49.

Hot Spare sleds

In most configurations, if a member of a virtual device becomes degraded, you must swap out the faulted sled as defined in *Hot Swap Operating Instructions* on page 69. If you have not enabled **AutoRebuild**, you must also start a manual rebuild.

However, you may designate Hot Spare sleds as replacements for faulted sleds without intervention by you or a host. These sleds, once designated as Hot Spares, are not available for other use.

See *Optional Hot Spare Sled* on page 50 for more information.

Zones

Zoning is a collection of related Diamond capabilities supporting flexible Diamond-VT configuration management configurable via CLI commands in the Command Line Interface or the

Advanced CLI configuration page of the ExpressNAV interface. Zoning supports security by granting or denying access between initiators and devices as defined by an administrator.

A zone is a collection of devices which can access each other. The devices in a zone usually include one or more initiators, one or more devices, and one or more paths between the initiators and the devices.

Interleave

The interleave size sets the amount of data to be written to each drive in a RAID group. This is a tunable parameter which takes a single stream of data and breaks it up to use multiple disks per I/O interval.

- The default sector interleave in RAID Level 10 is 128 blocks (64k).
- The default sector interleave in RAID Level 5 is 256 blocks (128k).

The CLI command **RAIDInterleave** allows you to change the size of the sector interleave between RAID groups. The value will depend upon the normal expected file transfer size. If the normal file transfer size is large, the interleave value should be large, and vice versa.

The value entered for the **RAIDInterleave** command refers to blocks of data: one block is equivalent to 512 bytes of data.

Valid entries are 16, 32, 64, 128, 256 and SPAN. SPAN, not available in RAID Level 5, indicates that interleave size between the drives in the group will be the minimum drive size of all members in the group.

Enhancing performance

SpeedWrite, enabled by the CLI command **SpeedWrite**, improves the performance of WRITE commands.

7.1 Virtual Tape

When the Diamond-VT is configured as a Virtual Tape, it is divided into several tape volumes based on your choice and the RAID level you choose.

Virtual Tape provides increased performance by reducing the time needed to backup and restore data. Virtual Tape volumes reside on Virtual Drives. The Diamond-VT appears to hosts as a tape library, allowing ISV packages to issue a set of tape library commands to perform backup and restore operations to the Diamond-VT.

The underlying storage used for Virtual Tape is specified using the QuickTape command.

The simplest way to set up Virtual Tape configurations is to use the ExpressNAV interface. See *ATTO ExpressNAV: Browser-based Interface* on page 23 for more information.

If you use the CLI, the command **QuickTape** sets up Virtual Tapes using the following format:

```
set QuickTape [RAID5|RAID10] [# tape volumes] [# tape drives] <enabled> <Barcode Prefix>
```

Hot Spares are not available for all Virtual Tape configurations. You must designate **enabled** to allow Hot Spare sleds or **disabled** to forgo Hot Spare sleds. Refer to and *Optional Hot Spare Sled* on page 50 for more information and examples.

You may specify the first four to six alpha-numeric characters of a tape bar code, used by

tape backup software. The remaining four characters will be entered by the system automatically to identify the tape number.



Note

The maximum number of tape volumes and tape drives for RAID Level 5 is 30.

The maximum number of tape volumes and tape drives for RAID Level 10 is 15.

Configuration examples

RAID Level 10 with Hot Spare sleds

```
set QuickTape RAID10 15 1 enabled
SaveConfiguration Restart
```

The Diamond-VT will be configured into RAID Level 10 with one tape drive, 15 tape volumes and two Hot Spare sleds.

RAID Level 5 and no Hot Spare sled

```
set QuickTape RAID5 30 2
SaveConfiguration Restart
```

The Diamond-VT will be configured into RAID Level 5 with two tape drives and 30 tape volumes.

7.2 Optional Hot Spare Sled

To maintain array up time with minimal risk of data loss, individual sleds which fail may be replaced with a spare sled.

In most configurations, if a member of a virtual device becomes degraded, you must swap out the faulted sled as defined in *Hot Swap Operating Instructions* on page 69. If you have not enabled **AutoRebuild**, you must also start a manual rebuild.

However, Hot Spare sleds may be designated as replacements for faulted sleds without intervention by you or a host.

Each configuration requires a certain number of Hot Spare sleds. These sleds, once designated as Hot Spares, are not available for other use.

- RAID Level 10: 10 drive sleds and two Hot Spare sleds (sleds 11 and 12).
- RAID Level 5: 10 drive sleds and two Hot Spare sleds (sleds 11 and 12)
- RAID Level 5: five drive sleds (sled positions 1 through 5) and one Hot Spare sled (sled 12).



Note

All arrays using RAID level 10 and Hot Spares options must be fully populated.

If a sled becomes degraded and a Hot Spare sled has been designated:

- the Diamond will replace the degraded sled with the Hot Spare sled, simulating a hot swap of a sled with **AutoRebuild enabled**, without intervention
- any sled with a Faulted drive will not be used. Faulted sleds maintain their faulted status until they are removed and re-inserted or if the system is restarted.
- Hot Spares are handled as sleds, not as individual drives
- the Hot Spare sled replaces the Faulted sled in the Virtual Device

- a rebuild will automatically start after the Hot Spare is switched into the Virtual Device, even if **AutoRebuild** is disabled.
- the **DriveInfo** command will list the number of Hot Spare sleds currently in the system
- you can replace the faulted drive or sled later. However, faulted is a non-persistent state. After a power cycle, the faulted sled will display on the **DriveInfo** screen as having no type, i.e, the **type** field will be blank. The sled cannot be accessed but must be removed and replaced. If it is replaced, it will become part of any open Virtual Disk in this order:

- 1 if a Virtual Device is missing a sled or you are hot swapping a sled, the new sled becomes part of the existing Virtual Device.
- 2 if a Hot Spare sled is missing, the new sled will become a Hot Spare sled.

The simplest way to set up Hot Spare sleds is to use the ExpressNAV interface. However, you may use the CLI as follows:

To set up RAID Level 10 with Hot Spare sleds

- 1 Connect to Diamond-VT services (see *Accessing the Diamond-VT* on page 15) and use the CLI.
- 2 Type **set QuickTape RAID10 15 1 enabled**
- 3 Type **SaveConfiguration Restart**

The Diamond-VT will be configured into RAID Level 10 with one tape drive, 15 tape volumes and two Hot Spare sleds.

To set up RAID Level 5 and Hot Spare sleds

- 1 Type **set QuickTape RAID5 30 2 enabled**
- 2 Type **SaveConfiguration Restart**

The Diamond-VT will be configured into RAID Level 5 with two tape drives, 30 tape volumes and two hot spare sleds.

7.3 Zones

Zoning is a collection of related Diamond-VT capabilities supporting flexible Diamond configuration management configurable via CLI commands in the Command Line Interface mode or in the Advanced CLI Configuration page in the ExpressNAV interface. Zoning supports security by granting or denying access between initiators and devices as defined by an administrator.

A zone is a collection of devices which can access each other. The devices in a zone usually include one or more initiators, one or more devices, and one or more paths between the initiators and the devices.

To set up zones, use the Command Line Interface (see *Accessing the Diamond-VT* on page 15) or the Advanced CLI page in the ExpressNAV interface. Zone CLI commands only take effect after you enter the ZoneCommit command.

The individual elements are referred to as device_lun, host_name, port_number and zone_name as defined in Exhibit 7.3-1.

Exhibit 7.3-1 Definitions of zone configuration entries.

device_lun	The LUN of the RAID drive
host_name	In a Fibre Channel environment, the WWPN; in a SCSI environment, SCSI Initiator ID
port_number	The Diamond port number (0, 1) for the data path
zone_name	Alphanumeric or ‘_’ character string less than or equal to 16 characters long

Principles of Zoning

Zoning provides a validation filter for each SCSI command.

Each zone entry includes a named zone, a host portion, a port portion and a device portion. The components of a valid path from a host to a device satisfy the following conjunction:

<host_name> AND <port_list> AND
device_list>

The zone is named to identify it from other zones. It appears as **zone_name** in this manual.

The host portion defines the valid access path from a host through a port to a device (LUN), representing the Initiator ID in a SCSI

environment or the World Wide Port Name in a Fibre Channel environment. It appears as **host_name** in this manual.

The device portion defines the LUN(s) participating in the zone. It appears as **device_lun** in this manual.

The port portion defines the Fibre Channel or SCSI port in the Diamond-VT. It appears as **port_n** in this manual.

The process: Each command received by the Diamond-VT is parsed to determine its host/HBA identifier, its port number and the target LUN, forming the zone nexus. This zone nexus is looked up in the defined zones table. If the zone nexus is present, the operation continues; if it is not found, the command is rejected with the appropriate status and sense data.

Two zone configurations accessed through the Command Line Interface regulate zoning:

The Planned configuration is a work-in-process configuration used to build or edit the desired configuration. The Planned configuration does not control I/O access until it is transformed into the Active Zone Configuration via successful completion of the **ZoneCommit** command.

Other than as a site for zone configuration editing, the Planned configuration has no impact on the Active configuration or the Diamond-VT. Changes to the Planned configuration may be made without considering synchronization with other configuration commands.

Use the **ZoneClearAll** command to clear the Planned configuration.

If, while working in the Planned configuration, you decide you want to negate that configuration and edit the Active configuration, use the **ZoneRetrieve** command. The information from

the Active configuration will be copied into the Planned configuration.

To determine what is in the Planned configuration, type **ZoneInfo Planned**.

Active configuration is persistent and establishes the Diamond zoning configuration after power-up.

The Planned configuration becomes the Active configuration after successful execution of the **ZoneCommit** command. The Active

configuration is replicated as the Planned configuration after the successful **ZoneCommit**, after power-up and after **ZoneRetrieve**. This replication eases incremental modifications to the current zone configuration: you only need to enter changes. Modifications to the Planned Configuration made before **ZoneCommit** are not persistent and are lost in the case of power-up. To determine what is in the Active Configuration, type **ZoneInfo**.

Factors to consider

Several factors must be considered when configuring a Diamond-VT with zones:

- Be careful when changing Diamond-VT zoning configurations. Internal validation logic cannot detect misconfigurations.
- The Diamond-VT zoning may be driven by external applications which handle considerations such as aliasing of parameters.
- Stopping or pausing I/O operations during zoning changes is the responsibility of the host computer, external to the Diamond-VT.
- You must refer to a device by a consistent LUN across zones in accordance with Fibre Channel specifications.

- RAID configuration changes require planning and preparation independent of whether any zones are enabled. Such changes affect data integrity, and any write to an incorrect LUN may result in data corruption.
- Degraded operation and RAID rebuilding occur at a lower level than the Zoning features. SCSI command operation continues to operate, and you can modify the Zoning configuration via the **ZoneCommit** command at any time.
- Zone validation of switch/fabric routing is not supported. The Diamond-VT operates within a SAN environment including host systems, host bus adapters, switches and other devices. The Operating System you use may limit zoning flexibility in your SAN.
- You may create up to 32 zones. Each zone may have up to two ports, up to 24 devices and up to 32 hosts.

Status and Sense Data

Commands sent to a device may be rejected with sense key, code, qualifier as follows:

LOGICAL UNIT NOT CONFIGURED: 68 00 00

No such LUN exists; the initiator does not have access to this LUN

LOGICAL UNIT NOT SUPPORTED: 25 00 00

The Logical unit is not in an accessible zone

LOGICAL UNIT NOT READY: 04 03 00

The Logical unit is in an accessible zone, but is not ready; it may be offline or busy

If the logical unit inventory changes for any reason, including completion of initialization, removal of a logical unit, or creation of a logical unit, the device server generates a Unit Attention command for all initiators, telling them a **ZoneCommit** procedure has been successful. The device server sets the additional sense code to

REPORTED LUNS DATA HAS CHANGED: 3F 0E 00 (LUN has been added to or removed from the zone)

Configuring Zoning



CAUTION

Be careful when changing Diamond-VT zoning configurations. Internal validation logic cannot detect misconfigurations

An unrestricted zone configuration, exactly mimicking the LUN configuration, is created internally after the *first* power-up or restart after installation of the Diamond-VT. No special operating modes are required and Zoning can be easily installed with no impact on previous configurations. The unrestricted zone can be considered an all/all/all zone: all hosts, all ports and all devices.

Examples of initial configurations are available in *Sample Zoning Command Sequences* in the Appendix on page ix.

To create a zone

- 1 The Diamond-VT must be configured to the appropriate QuickRAID configuration before applying the Zoning configuration.



Note

Interpretation of the Zoning command is a single forward pass, so any entities referenced in any command must have been previously defined or you will receive an error message.

- 2 Type **ZoneInfo Planned** to determine the status of a Planned Zone Configuration.
- 3 Type **ZoneInfo** to determine the status of an Active Zone Configuration.
- 4 If you want to start fresh and create zones without reference to the definitions in the current Active Zone Configuration, type **ZoneClearAll** to remove all entries from the Planned zone definition table.
- 5 Create a new named zone. Type **ZoneCreate zone_name**

- 6 Add the devices, hosts and ports you want to include in the zone.

ZoneAddDevice zone_name device_lun

ZoneAddHost zone_name host_name

ZoneAddPorts zone_name port_number

- 7 Enable the zone, type

ZoneState zone_name enabled

- 8 Type **ZoneCommit** to make this Planned Zone Configuration the Active Zone Configuration.

See *Sample Zoning Command Sequences* in the Appendix on page ix.

If the Diamond pauses operation by using a queue while a ZoneCommit command is executing

- 1 The Diamond-VT completes any in-process I/O requests received before the ZoneCommit command was issued
- 2 The array performs the zoning changes
- 3 The array resumes I/O operations.

To remove zones

- 1 Remove the named zone. Type **ZoneRemove zone_name**
- 2 Type **ZoneCommit** to commit this Planned Zone Configuration to become the Active Zone Configuration.

To change current zones



CAUTION

Be careful when changing Diamond-VT zoning configurations. Internal validation logic cannot detect misconfigurations

- 3 Type **ZoneInfo Planned** to determine the status of a Planned Zone Configuration.
- 4 Type **ZoneInfo** to determine the status of an Active Zone Configuration.
- 5 If necessary, type **ZoneRetrieve** to overwrite the Planned configuration with the current Active configuration.
- 6 Create or delete named zones as outlined above.
- 7 Add or delete devices, hosts and ports as outlined above.
- 8 Type **ZoneCommit** to make this Planned Zone Configuration the Active Zone Configuration.

Other operations

- To disable a zone, type
ZoneState zone_name disabled
- To clear the Planned Zone Configuration of all entries, type
ZoneClear All
- To restore the Diamond-VT to factory default, type
ZoneClearAll
- Type **ZoneCommit**

Errors

Zone definition tables: The Zone commands manage entries in the Zone definition tables which manage the overall zoning process. Definition tables are indexed by unique keys (**zone_name**). All definition tables are repositories for their respective data and participate in establishing the configuration by executing the **ZoneCommit** command.

The integrity of these tables is essential to the data integrity of the Diamond-VT. If the Zone definitions are faulty problems can occur. Although Zone command processing provides a level of command and configuration validation, you must be very careful managing configurations with any zoning system.

Validation of the command line is performed before the command is deemed acceptable to be executed.

These descriptions are generalizations.

- Configuration inaccuracies occurring before application or operating system data is written to the drives may have no impact on the Diamond-VT, but results after an operating system or application have written to the drives are unpredictable.

- Incorrect Zone entries can include mis-specification of resources to a zone.
- Verify each command line is properly formed (number of parameters, proper spelling of keywords).
- For commands defining entities, the name being defined must not already be defined.
- If you want to undefine an entity, the name being undefined must already be defined. (A warning will be displayed if the name to be undefined doesn't exist.)
- World wide port names are validated according to basic format rules. Content verification of WWPN occurs at runtime.
- LUN must be in the range defined by the RAID<n> configuration.
- Errors detected in the CLI command line are described in Exhibit 7.3-1.
- Errors detected while writing the Active Zone Configuration result in an error message and no change to the zoning configuration. The Active configuration continues to match the persistent configuration.
- Errors detected while reading the Active Zone Configuration result in an error message and the zoning configuration remains unchanged.

8.0 Updating Firmware

Engineers, technicians and/or system administrators/integrators may update the firmware of the Diamond-VT using the Command Line Interface (CLI) (See *Accessing the Diamond-VT* on page 15) via the RS-232 serial port or the optional Ethernet management services card.

Updating firmware via the RS-232 serial port

To update the firmware via a connection to the RS-232 serial port, you will need

- a host computer with a terminal emulation program such as HyperTerminal in Windows
- binary information file (“...”.ima) available from technical support or on our website (see *Warranty* on page A-xv)
- a null modem serial cable with a DB-9 connector

- 1 Connect to Diamond-VT services via the RS-232 port (see *Accessing the Diamond-VT* on page 15). You should now be in the Command Line Interface mode.
- 2 Copy the latest Diamond-VT image file (“...”.ima) onto the host computer.
- 3 Type **ZModem Receive** at the **Ready** prompt. The terminal program on the host should be in Zmodem only mode, with no other parameters. The Diamond-VT will display information that it is preparing to receive a file from your terminal program.
- 4 On the terminal program, choose **Transfer Send File**

- 5 In the **Send File** box, enter the current Diamond flash (“...”.ima) filename or click the browse button to find it.
- 6 Click **Send File**
- 7 The Diamond should acknowledge receiving the file and display a message not to interrupt power for 90 seconds.



CAUTION

Do not interrupt the flash process. If the process is interrupted, the Diamond-VT will become inoperable and will have to be returned to the factory for repair.

Do not turn off the Diamond-VT until the display returns the Ready prompt.

- 8 If upgrading the firmware from versions older than 2.5.3, follow the procedures outlined in *Resetting Defaults* on page 63.
- 9 When the flash procedure is complete, cycle power on the Diamond-VT.

Updating firmware via the optional Ethernet card

To update the firmware via the optional Ethernet management services card, you will need

- the optional Ethernet management services card installed in your Diamond-VT
- a host computer with a network card or a network-connected device such as a hub
- binary information file (“...”.ima) available from technical support or on our website (see *Warranty* on page A-xv)
- a crossover network cable for a direct connect or standard network cable if attached to a network device

- a valid IP address

- 1 To connect to the Ethernet and set up your host computer, refer to *Ethernet Access: Telnet and SNMP Protocols* on page 21.



Note

The host computer must have appropriate network settings to allow it to communicate with the Diamond-VT. Please see your system administrator for more information.

- 2 Turn on the Diamond-VT.

- 3 Copy the latest Diamond-VT image file (“...”.ima) onto the host computer and note its directory

```
c:\diamond\flash\....ima
```

- 4 Change directories to the place where you copied the “...”.ima file

```
cd c:\diamond\flash
```

- 5 Open an FTP session using a user-defined IP address or the default (10.0.0.1) if it has not changed. The IP address must be a valid address for your network.

- 6 At the FTP login prompt, type **sysadmin** as the userID.

- 7 Press **Enter** at the password prompt.

- 8 Type **put “...”.ima**.

The Diamond should acknowledge receiving the file and display a message not to interrupt power for 90 seconds.



CAUTION

Do not interrupt the flash process. If the process is interrupted, the Diamond-VT will become inoperable and will have to be returned to the factory for repair.

Do not turn off the Diamond-VT until the display returns the Ready prompt.

- 9 If upgrading the firmware from versions older than 2.5.3, follow the procedures outlined in *Resetting Defaults* on page 63.
- 10 When the flash procedure is complete, cycle power on the Diamond-VT.

9.0 Diagnostics, Upgrade and Maintenance

The Diamond-VT provides a number of visual, audible and computer system-generated indicators to identify the operational status of the array. System status and error information is readily available. Various methods are available to correct problems or to upgrade equipment and firmware.

RS-232 Monitoring Port and CLI One tool to support a Diamond-VT is a host computer with an RS-232 port and terminal emulation software. Using this computer, you can hook up a null modem serial cable to the RS-232 port on the Diamond-VT management card and control the array via the Command Line Interpreter (CLI) management software built into the array. The CLI can be used to configure the unit, modify key parameters and read back key system information. (See *Accessing the Diamond-VT* on page 15)

Ethernet Monitoring Port and CLI If the optional Ethernet management system card has been installed, you may use the RJ45 Ethernet port and Telnet to access the CLI software on the Diamond-VT. Use the same CLI commands to configure, modify or read key systems information (see *Accessing the Diamond-VT* on page 15) or the ExpressNAV browser-based interface. If you restart the array, the Telnet session will end and the session cannot be re-established until the array completes its Power On Self Test.

Power On Self Test (POST) Each time the Diamond-VT array is powered up, it will perform a series of internal tests called POST (Power on Self Test). The POST sequence takes from 1 to 2 minutes to complete.

The Diamond-VT LEDs will blink at various points in the test sequence and, if the RS-232 system management port is connected, a list of tests and test results will scroll across the screen. When the POST is nearly complete, all the LEDs on the array will flash simultaneously twice in a row. If the system is fully operational, the ready LED will be lit and the unit is ready to be accessed. If the POST fails, the System Fault LED will be lit and an error code will be flashed.

Ready LED The Ready LED (RDY) indicates the operational status of the Diamond-VT.

At power up, the green Diamond Array Ready (RDY) LED is disabled until successful completion of the POST (Power On Self Test) indicating the array is ready for normal operation. If a host computer is hooked to either Fibre Channel or SCSI port, the Ready LED will momentarily blink and then stay lit if the connection is good. If that host is rebooted, the Ready LED will blink again and stay on once the connection is reestablished.

Audible Alarm The Diamond-VT audible alarm warns of potential problems or faults. It beeps twice at power up to indicate it is operational and will beep repeatedly when the System Fault (FLT) light on the system management card is activated. The alarm will turn off when the fault condition is cleared or the alarm can be disabled by issuing an AudibleAlarm disabled or PowerAudibleAlarm disabled command via CLI as described in *Maintenance Services Commands* on page 38. Disabling the alarm for a specific error will not silence the alarm for other errors.

Thermal Monitoring The Diamond-VT provides advance warning of temperature problems through visual, audible and software warning mechanisms and through an automatic system which protects the disk drives under abnormal operating or ambient conditions.

The Diamond-VT will function under normal external operating temperatures of 5°C and 40°C. Temperature sensors provide data to the software to trip a temperature warning alarm and will, at excessively high or low temperatures, flush cache memory to prevent data loss and disable disk drive activity to protect the drives. The Diamond reports the temperature via SES, SNMP, CLI and the Status page of the ExpressNAV interface as well as the state of the temperature warning alarm (Not Present, OK, Warning, Critical). The

temperature warning alarm will report OK during normal operating conditions.

In an abnormal operating condition, such as blower failure, under high ambient temperatures when the Diamond internal midplane temperature reaches a critical point, the temperature alarm will report Warning and activate the audible alarm and fault LED on the front of the unit. If the internal

midplane temperature were to reach a higher point, the temperature warming alarm will report Critical, the Array will be taken off line, and all disk drive activity will be disabled. When the ambient temperature decreases to within standard operating range, the drives will be powered back on and the host will be allowed to access the data.

Exhibit 9.0-1 Typical Diamond-VT operation over a range of external ambient temperatures. Alarms will be audible, visual, CLI and SES cues as described above.

Temperature Condition	25°C blowers OK	25°C 1 blower fails	32°C blowers OK	32°C 1 blower fails	35°C blowers OK	35°C 1 blower fails	40°C blowers OK	40°C 1 blower fails
Read/Writes	normal	normal	normal	normal	normal	normal	normal	Array offline
Alarms	OK	OK	OK	OK	OK	WARNING	OK	CRITICAL

Power Supply Monitoring The Diamond-VT monitors the operation of its power supplies and blower assemblies every 30 seconds. If the status changes, the system reports it visually with an LED and a message in the CLI.

If a power supply or blower fails, the management system sends a CLI message and turns off the corresponding power supply LED.

The blower assembly directly adjacent a power supply must be functioning properly for the power supply to work properly. If a blower assembly fails, the power supply will shut down and the management system will send a CLI message. The corresponding power supply LED on the system management card will also turn off.

If a good replacement power supply or blower assembly is inserted into the array, the management system will send a CLI message and the corresponding system management card LED will go on. It may take up to 30 seconds for the system to note these changes.

System Fault LED and Error Codes If a serious hardware or software error occurs in the Diamond-VT, the System Fault LED will display a series of flashes or blink codes. Error information will be reported via the Command Line Interface if it is operational.

At power up, the green Diamond Array Ready (RDY) LED turns on after successful completion of the POST (Power On Self Test) indicating the array is ready for normal operation.

During operation, the Ready LED will stay lit even if the amber Fault (FLT) LED lights.

If a serious error occurs in the array, the amber Fault LED will flash repeatedly in a blink code pattern:

- an initial series of blinks indicating the system problem

Number of blinks	Problem area
1, 2 or 3	processor or memory
4	Fibre Channel interface
5	SCSI interface
7	Fibre Channel connection
8	general internal processing
9	SCSI Enclosure Services

- a two second pause
- another series of blinks providing more detailed information for technical personnel.
- a four-second pause
- the blink code sequence will repeat from step 1 until the error is cleared.

In general, any fault will require notification of Diamond Array technical personnel for resolution or for further debug instructions. When you report

an error code, please provide both the first and second blink code values.

During a fault condition, more detailed information about the fault may be available via the CLI or the ExpressNAV interface over the RS-232 interface port or the optional Ethernet port. These error messages should be reported to technical personnel to assist in debugging the problem.

The blink codes are also saved internally by the array to NVRAM (Non Volatile Random Access Memory) and will be displayed at power up if the power to the array is recycled.

Disk Drive Activity and Disk Fault LEDs Each dual disk drive sled assembly contains two green activity LEDs and an amber disk fault LED. Once the system has successfully powered up and passed POST, the green activity LEDs are full on and the disk fault LED off.

The Drive 1 and Drive 2 activity LEDs will stay full on when the system is operational and no disk drive activity is present. As the disk drives are accessed, the green LEDs will flash. If the disk drives are heavily accessed the green activity LEDs will appear to flash at a high rate or may even appear to be completely turned off.

The amber disk fault LED will be off under normal operation. If either of the disk drives on a dual disk drive assembly reports a disk error of

any kind, the amber disk fault LED will come on. The disk fault LED can be activated by minor issues such as a disk drive writing to a bad sector (which is usually corrected by the disk drive the next time it writes) or major issues such as a head crash or complete drive failure.

When the disk fault LED is turned on, the system will issue a detailed message via the CLI. These messages are not written permanently to the error log file but should be recorded to help assess the disk problem.

If the disk drive error is a non fatal error and the drive is still functional, the array will continue to read and write data to the disk drive but the disk fault LED will remain on. If you repeat a drive command or action and it completes successfully, the disk fault LED may have been set by an anomaly in the disk drive. You can clear the Disk Fault LED by either power cycling the array or issuing the `SledFaultLED` command in CLI as per *Maintenance Services Commands* on page 38

If you repeat a disk command or action and the disk fault LED remains on, the disk error may be serious. You should write down the error message issued by the CLI and contact technical support via the means easiest for you for assistance (see *Warranty* on page A-xv). If you choose to replace the suspected faulty dual disk drive sled assembly, follow the appropriate procedures.

9.1 Troubleshooting

The Diamond-VT provides a number of indicators to identify the operational status of the array. System status and error information is readily available. If your situation is not defined here or elsewhere in the manual, if these solutions do not help, or if you have any questions or concerns about any aspect of operating the Diamond-VT, contact technical support.

Windows 2000 special instructions

When using Windows 2000 and booting up the Diamond-VT for the first time, the **New Hardware** screen may ask for a driver. While a driver is not necessary, install a dummy driver to eliminate the screen's appearance. Download AttoDM2k.zip from www.attotech.com, unzip it, and install the driver according to the instructions in AttoDM2k.pdf.

Error Messages

System Fault LED If a serious hardware or software error occurs in the Diamond-VT, the **System Fault LED** will display a series of flashes or blink codes.

- an initial series of blinks indicate a system problem

Number of blinks	Problem area
1, 2 or 3	processor or memory
4	Fibre Channel interface
5	SCSI interface
7	Fibre Channel connection
8	general internal processing
9	SCSI Enclosure Services

- a two second pause
- another series of blinks providing more detailed information for technical personnel.
- a four-second pause
- sequence repetition from step 1 until the error is cleared.

In general, any fault will require notification of Diamond Array technical personnel for resolution or for further debug instructions. When you report an error code, please provide both the first and second blink code values.

During a fault condition, more detailed information about the fault may be available via the CLI or the ExpressNAV interface over the RS-232 interface port or the optional Ethernet port. The blink codes are saved internally by the array to NVRAM and are displayed at power up.

Command Line Interface messages

ERROR. Wrong/Missing Parameters

Check Help for the correct input and retype command

ERROR. Invalid Command. Type 'help' for command list

Check Help to find a list of all commands which are available. Contact Diamond-VT technical support via the means easiest for you. Refer to *Warranty* on page A-xv for additional information.

ERROR. Command Not Processed.

The Diamond-VT did not accept the command you requested. Check Help for a list of commands or check this manual for the function you wish to access. If you cannot accomplish what you want to do with the commands listed, contact Diamond-VT technical support via the means easiest for you.

Audible Alarm The Diamond-VT audible alarm will warn of potential problems or faults. It will beep repeatedly when the System Fault (FLT) light on the system management card is activated. The alarm will turn off when the fault condition is cleared or the alarm can be disabled by issuing AudibleAlarm disabled or PowerAudibleAlarm disabled command via CLI as described in *Maintenance Services Commands* on page 38. Disabling the alarm for a specific error will not silence the alarm for other error conditions.

Specific situations and suggestions

For all problems, first check the pages of the ExpressNAV interface appropriate for the problem especially the **Status** and **Storage Management** or use the appropriate CLI commands

If a drive fails to respond

- Determine which drive has failed by observing the amber fault LED on the drive sled or connect to the CLI and type `driveinfo` for a list of all drives and their status.
- For specific information on a particular drive in CLI, type `driveinfo [sled number] [drive number]`. Record all errors.

- Follow the instructions in the appropriate chapters of this manual to remove, replace and reconfigure the drive such as *Hot Swap Operating Instructions* on page 69.
- You may copy drives by using Command Line interface commands. Refer to *Drive Management Commands* on page 41.

If a power supply fails

- Verify the power cord is correctly plugged and there is power at the power receptacle.
- If there is power, the cord is secure and the blower and power supply LEDs are off, replace the blower unit. Refer to *Hot Swap Operating Instructions* on page 69.
- If there is power, the cord is secure and the power supply LED is off, but the blower LED is on, replace the power supply. Refer to *Hot Swap Operating Instructions* on page 69.
- Command Overlap: The Diamond-VT contains special software to take advantage of the Command Overlap feature offered in some high performance disk drives. Because all 24 disk drives in a Diamond Array may be seeking at the same time under Command Overlap, only Diamond-VTs with two operational power supplies and blower assemblies will support Command Overlap: the Diamond-VT will automatically disable the Command Overlap feature if a power supply fails and notify the system administrator through the audible alarm and CLI.

If you cannot read or write to the Diamond-VT

You may have lost connection to the host via the Host Interface Card. The HIC LED on the back of the Diamond-VT should be lit green. The amber LED should go out and the green LED should light when the connection is complete.

Also check the host bus adapter (HBA) in the host machine for proper functioning and drivers.

- Verify that the connector and both ends of the cable are completely seated.
- Try connecting directly to the host, bypassing any hubs or switches.

To determine if the problem exists with the Host Interface Card or the connection

- Swap the cable from one HIC to the other HIC.

- If the LED is now green, swap the GBIC and cable back to the original HIC. If the LED is green, then the GBIC is defective; if it is amber, the HIC is defective.
- Swap the defective HIC or GBIC (see *Hot Swap Operating Instructions* on page 69)

If you can't access the Diamond-VT CLI via Ethernet

- Verify there are three or fewer concurrent sessions using Telnet or FTP. You may be the fourth session or someone in another session has entered a command which requires a Save Configuration command.
- Verify you are using a crossover cable for direct connection, or a network cable for a network connection.
- Verify the Diamond-VT is set to **IPDHCP enabled** if you expect an IP address will be assigned by the network and DHCP is an option available on the network.
- Verify the IP address is compatible with the host.
- Verify the system is functioning and accessible via in-band inquires such as Disk Management.
- Try setting your terminal emulator with a different baud rate, starting at 2400, then 9600, 19200, 38400, 57600, and 115200.
- If you perform a hardware restart, the Ethernet connection is dropped. You must re-establish the Ethernet connection.
- If you enter a command that requires a **Save Configuration** or **RestoreConfiguration** command in either the serial interface window or the Ethernet connection window, you will not be able to access the inactive window until the command is complete in the active window.
- If you still fail to communicate with the Diamond-VT, swap out the management card and try to connect using default settings.

If you do not see the appropriate number of LUNs on the host machine

- Ensure any configuration changes are appropriate
- Type **FirmwareRestart** in CLI
- Re-start the host computer
- Verify all drives associated with the missing LUN(s) are inserted properly and powered up.

9.2 Resetting Defaults

Resetting the Diamond-VT to defaults will not alter the RAID configuration, zoning configuration, IP configuration or Telnet information. However, resetting the Diamond-VT to factory defaults is a last-ditch effort to recover from corrupt configurations or complete failure. All data will be lost, but the zoning configuration will remain.



CAUTION

Data will be lost if you follow these procedures. Make sure you have no other choice before resetting the Diamond-VT to factory defaults.

Default

If you need to return to the default settings of the Diamond-VT but do not want to lose data or Ethernet settings, use the CLI command `RestoreConfiguration default` in CLI mode or in the **Advanced** CLI configuration page of the ExpressNAV interface.



Note

Using `RestoreConfiguration default` or `RestoreConfiguration factory default` will not affect the zoning configuration. To restore the Diamond-VT to factory default, type

`ZoneClearAll`
`ZoneCommit`

Return to Default settings

1 Connect to Diamond-VT services via the RS-232 port or the optional Ethernet management services card (see *Accessing the Diamond-VT* on page 15). You should now be in Command Line Interface. Continue with the CLI or access the ExpressNAV interface (see *ATTO ExpressNAV: Browser-based Interface* on page 23).



Note

Because the ExpressNAV pages take you through this process easily, the following instructions are based on the CLI commands. Use these instructions as a guide in ExpressNAV.

- 2 Type `RestoreConfiguration default` to reset the system configuration (See Exhibit 9.2-2 for a list of configurations which will be changed).
- 3 Type `FirmwareRestart` or cycle power of the Diamond-VT.

- 4 Reboot the host PC after the Diamond-VT completes its power on cycle.

Factory Default

Resetting the Diamond-VT to factory defaults is a last-ditch effort to recover from corrupt configurations or complete failure. All data will be lost.



Note

Using `RestoreConfiguration default` or `RestoreConfiguration factory default` will not affect the zoning configuration. To restore the Diamond-VT to factory default, type

`ZoneClearAll`
`ZoneCommit`

To reset to Factory Defaults, firmware version 2.5.3 or higher

- 1 Connect to Diamond-VT services via the RS-232 port or the optional Ethernet management services card (see *Accessing the Diamond-VT* on page 15). You should now be in Command Line Interface.
- 2 Continue with the CLI or access the ExpressNAV interface (see *ATTO ExpressNAV: Browser-based Interface* on page 23).



Note

Because the ExpressNAV pages take you through this process easily, the following instructions are based on the CLI commands. Use these instructions as a guide in ExpressNAV.

- 3 Type `RestoreConfiguration factorydefault` to reset the system configuration. (See Exhibit 9.2-2 for a list of configurations which will be changed).
- 4 Type `FirmwareRestart` or cycle the Diamond-VT power.
- 5 Reboot the host PC after the Diamond-VT completes its power on cycle.

Exhibit 9.2-2 Configurations which will be changed during a RestoreConfiguration command

Command	Default	Reset if default chosen	Reset during factorydefault
AudibleAlarm	Disabled	▼	▼
AutoRebuild	Disabled		▼
DiamondName	“ ”		▼
EthernetSpeed	Auto		▼
FcConnMode	Loop		▼
FcDataRate	Auto	▼	▼
FcFairArb	Enabled	▼	▼
FcFrameLength	2048	▼	▼
FcFullDuplex	Enabled	▼	▼
FcHard	Disabled	▼	▼
FcHardAddress	0x03	▼	▼
IdentifyDiamond	Disabled	▼	▼
ldeTransferRate	4	▼	▼
IPAddress	10.0.0.1		▼
IPDHCP	Disabled		▼
IPGateway	0.0.0.0		▼
IPSubnetMask	255.255.255.0		▼
MaxEnclTempAlrm	47	▼	▼
MinEnclTempAlrm	5	▼	▼
RAIDInterleave	128		▼
SerialPortBaudRate	115200	▼	▼
SerialPortEcho	Disabled	▼	▼
SerialPortHandshake	None	▼	▼
SerialPortStopBits	1	▼	▼
SNMPSendTrap	Disabled	▼	▼
SNMPTrapAddress	10.0.0.1	▼	▼
SNMPTraps	4	▼	▼
SNMPUpdates	Disabled	▼	▼
TelnetPassword	diamond		▼
TelnetTimeout	Disabled		▼
TelnetUsername	telnet		▼
VerboseMode	Enabled	▼	▼

9.3 Rebuilding RAID Level 5 and 10 Configurations

If a sled must be removed and a new sled inserted into the Diamond Storage Array while it is configured in a RAID Level 5 or 10, you must rebuild the RAID Level using CLI commands or the ExpressNAV interface.



WARNING

Selecting RAID parameters causes all previous drive data on the Diamond Storage Array to be erased. Make sure all of your information is backed up before setting up RAID groups.

When you initially set up RAID groups using the QuickRAID command, groups are synchronized automatically because there is no pre-existing data on the drives. However, drives may display as “degraded,” and you need to set all LUNs to OK status.

The simplest method to check RAID group status is to access the **RAID** page of the ExpressNAV interface. See *ATTO ExpressNAV: Browser-based Interface* on page 23.



Note

Because the ExpressNAV pages take you through this process easily, the following instructions are based on the CLI commands. Use these instructions as a guide in ExpressNAV.

To reset LUN status

- 1 Display the status of the array by typing **RAIDRebuildStatus**.
- 2 Set the sleds which are listed as degraded to a rebuild state of **OK** by entering
set RAIDRebuildState [sled number] OK

Virtual Tape synchronization

The most efficient method to synchronize Virtual Tape configurations is to enable Hot Spares or the Auto Rebuild feature.

To synchronize mirrored drives automatically

If mirrored drives are removed for more than 15 to 30 seconds and then re-inserted or replaced, the replaced drives are labeled “degraded” when you check the Array’s status by typing **RAIDRebuildStatus**. If you enable **AutoRebuild**, the array rebuilds the degraded drives automatically when a new drive is inserted.



Note

Drive rebuilding reduces performance. You may want to leave **AutoRebuild** at the default **disabled** and manually rebuild during off-peak hours, or use the **RebuildPriority** command described below.

- 1 Connect to Diamond Storage Array services via the RS-232 port or the optional Ethernet management services card (see *Accessing the Diamond-VT* on page 15). You should now be in the CLI.
- 2 Continue with the CLI or access the **RAID** page of the ExpressNAV interface (see *ATTO ExpressNAV: Browser-based Interface* on page 23).
- 3 Type **AutoRebuild enabled**.
- 4 Information displays on the screen while the array updates NVRAM ending with a **Ready***.
- 5 Type **SaveConfiguration**.
- 6 Type **FirmwareRestart** to reboot the array.
- 7 Reboot the host computer connected via Fibre Channel or SCSI to the array.
- 8 To verify the configuration, type **RAIDRebuildStatus**
- 9 If a rebuild is necessary, the array will automatically rebuild drives.

Rebuild priority

Drive rebuilding reduces performance. Use the **RebuildPriority** command through the CLI or on the **RAID** page of the ExpressNAV interface to customize when your rebuilds will occur. Choices are **High**, **Low** and **Same**.

- If you select **High** priority, rebuild I/O requests are implemented before system I/O requests.
- If you select **Low** priority, rebuild I/O requests execute only when there are no pending I/O requests.
- If you select **Same** priority, rebuild I/O and system I/O receive equal consideration.

You must use a **SaveConfiguration Restart** command to implement the rebuild priority command.

To synchronize mirrored drives manually

The most efficient method to synchronize Virtual Tape configurations is to enable Hot Spares or the auto rebuild feature.

- 1 Connect to Diamond Storage Array services via the RS-232 port or the optional Ethernet management services card (see *Accessing the Diamond-VT* on page 15). You should now be in CLI.
- 2 Access the **RAID** page of the ExpressNAV interface (see *ATTO ExpressNAV: Browser-based Interface* on page 23).
- 3 Use the **VirtualDriveInfo** and **TapeVolumeInfo** commands to identify a Tape Volume associated with the RAID group you wish to rebuild.

- 4 Go to the **Move Medium** page.
- 5 Drag the selected Tape Volume into an unoccupied Tape Drive LUN.
- 6 From the CLI window, initiate a Rebuild operation from the Tape Drive LUN to the desired Drive Sled.



Note

When this rebuild operation has completed, the entire RAID group will have been rebuilt, effectively rebuilding all Tape Volumes associated with the underlying RAID Group: you do not need to rebuild each Tape Volume separately.

10.0 Hardware Maintenance

The disk drive sleds, blower assemblies, power supplies, host interface cards, and system management card may be replaced with identical or upgraded parts.



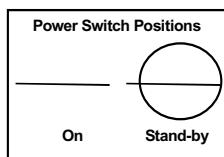
CAUTION

Do not leave empty openings on the front or rear of the Diamond-VT under any circumstances. Empty openings affect airflow and may cause the unit to overheat and shut down.



WARNING

The only way to completely de-energize the unit is to turn off both power supplies and unplug both power cords from the back of the unit. Turning the power switch to the Stand-by position on one power supply does not completely turn off power to the Diamond-VT; it is not an AC on-off switch. Power may still be in the unit through the other power supply.



CAUTION

All modular components must be replaced by qualified personnel only. Use a static wriststrap when handling any of the cards inside the Diamond-VT. Components are electrostatic sensitive. Use proper grounding methods when working with or around the Diamond-VT. Always store spare components in proper ESD containers when not in use.

- The power supply and blower assembly may be replaced while the unit is running. (See *Hot Swap Operating Instructions* on page 69)
- Host interface cards and management cards may only be replaced when the Diamond-VT is **off**. Backup the unit fully before replacing these components.
- You may remove a disk drive sled while the Diamond-VT is powered on. See the instructions in *Hot Swap Operating Instructions* on page 69 for details.

Management card: To remove a management card, power down both power supplies, loosen the screws holding the card in place, pull out the



Exhibit 10-1: The management card may be accessed via a serial port DB-9 connector or an optional Ethernet connection.

assembly and replace it with another. Securely tighten all screws after replacing the component.

Disk drive sled: To remove a disk drive sled (Exhibit 10-2), loosen the screws on either side of the assembly, then pull on the assembly's handle and carefully slide it out of its bay.

FC or SCSI Host Interface Card To remove a Fibre Channel or SCSI Host Interface Card from the back of the Diamond-VT (Exhibit 10-3), power down both power supplies and remove any cable attached to the port. Loosen the retaining screws and pull the Host Interface Card out of the unit. To replace the card, push it back into the unit and tighten the retaining screws.

Power supply: To remove the power supply (Exhibit 10-4), press the Stand-by power switch to the off position, remove the power cord, and, using a No. 1 Phillips screwdriver, loosen the screws holding the assembly in place. Pull out the assembly and replace it with another. Securely tighten all screws after replacing the component.

Blower assembly: To remove a blower assembly (Exhibit 10-4), using a No. 1 Phillips screwdriver, loosen the screws holding the assembly in place. Pull out the assembly and replace it with another. Securely tighten all screws after replacing the component.

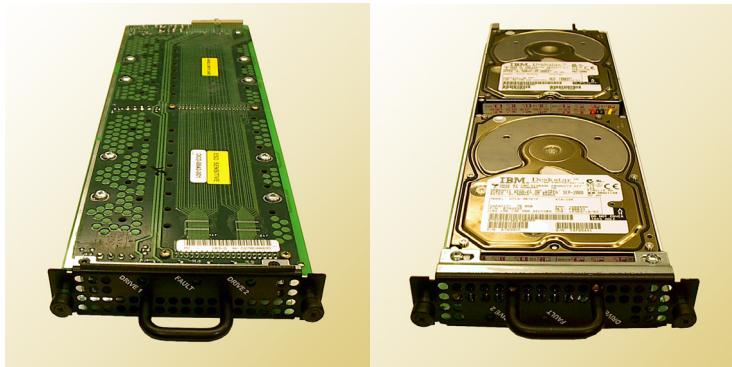


Exhibit 10-2: Above, disk drive sled partially pulled out of the Diamond Storage Array. Bottom left, top of disk drive sled. Bottom right, underside of disk drive sled showing individual drives



Exhibit 10-3: The Fibre Channel or SCSI Host Interface Card may be replaced by shutting power down, removing any cable attached to the port, removing the GBIC or SFP according to manufacturer's instructions, loosening the screws at the top and bottom of the card, then carefully pulling out the unit.



Exhibit 10-4: A power supply pulled out from a rackmount Diamond Storage Array: do not leave an empty opening while the Diamond Storage Array is operating. Access the blower assembly and the power supply by loosening the screws on either side of the component, then pulling out the part. If a blower or power supply stops working, keep it in place until another component is installed. (Note: host interface configuration pictured is not supported)

10.1 Hot Swap Operating Instructions

To maintain array up time, individual disk drive sled assemblies, power supplies and blower assemblies can be replaced with the unit fully operational. Special instructions need to be followed to perform these operations.

Disk Drives



CAUTION

- Individual disk drive sled assemblies may be replaced while the array is operating with no other intervention only if there is absolutely **no activity** on that drive.
- Failure to ensure **no activity** may destroy any data on that drive and possibly stop the entire Diamond-VT operation. Please follow the instructions below using CLI commands to replace drives.
- Do not leave empty openings on the front or rear of the Diamond-VT under any circumstances. Empty openings affect airflow and may cause the unit to overheat and shut down.
- All modular components must be replaced by qualified personnel only. Components are electrostatic sensitive. Use a static wriststrap when handling any of the cards inside the Diamond-VT. Use proper grounding methods. Always store spare components in proper ESD containers when not in use.

Follow your backup procedures before removing a sled. You may copy drives using the appropriate CLI commands (See *Drive Management Commands* on page 41).

The following method is the safest way to perform a hot swap of a drive.

The general approach: identify the disk drive sled to be replaced, take it offline using the appropriate CLI commands, turn off its power using CLI commands, remove and replace with a new disk drive sled, power up the new sled, and place back on line.

- 1 Connect to Diamond-VT services (see *Accessing the Diamond-VT* on page 15) and enter the Command Line Interface mode.
- 2 The fault LED should be blinking on the disk drive sled to be replaced. If it is not, type **set SledFaultLED [n] on**. The LED of the drive you want [n] will light.
- 3 Determine the Drive Sled Number. The disk drive sled closest to the management card is always the number 1 disk drive sled.

- 4 The Drive Sled Number identified in step 2 is the SledNum variable to be entered into the CLI commands. Take the disk drive sled offline by entering the following CLI commands at the control computer Ready prompt:

```
Set AtaDiskState (SledNum, 1, OFFLINE)  
Set AtaDiskState (SledNum, 2, OFFLINE)  
Set DriveSledPower (SledNum, OFF)
```



CAUTION

In a Hot Spare configuration, a drive sled should only be taken offline if there is absolutely no activity on that drive. If there is any activity, the rebuild of the Hot Spare sled may be flawed.

- 5 Wait 30 seconds for the disk drive sled to spin down and complete any remaining I/O activity.
- 6 Unscrew the two screws on the disk drive sled with the appropriate tool.
- 7 Carefully pull the disk drive sled out of chassis using its handle.
- 8 Mark or tag the disk drive sled with the Diamond Array serial number, the date removed, and its slot number.
- 9 Place the disk drive sled in an appropriate ESD container or bag.
- 10 Install the replacement disk drive sled into the array chassis using proper ESD control steps and with the proper orientation (The disk drive sled assembly is keyed and can only be inserted one way).
- 11 Tighten the two screws on the disk drive sled with the appropriate tool.
- 12 If you do not have **AutoRebuild** enabled, using the disk drive sled number identified in step 2, on the control computer **Ready** prompt type:

```
ClearDiskReservedArea (SledNum, 1)  
ClearDiskReservedArea (SledNum, 2)  
Set AtaDiskState (SledNum, 1, ONLINE)  
Set AtaDiskState (SledNum, 2, ONLINE)  
ResolveLUNConflicts
```

The new disk drive sled will be available for system use 10 to 15 seconds after the disk drives spin up and communication is reestablished.

Power Supplies



CAUTION

Do not leave empty openings on the front or rear of the Diamond-VT under any circumstances. Empty openings affect airflow and may cause the unit to overheat and shut down.



WARNING

Hazardous voltage and stored energy hazard when removing power supplies.

In a system with at least one operational power supply, the other power supply can be successfully removed and replaced without powering the system down and with no loss of array functionality. The green activity LED on the front of the system management card identifies the operational status of each power supply (Green means the power supply is operating correctly).



Note

System command overlap is discontinued across some drives when only one power supply is operational.

Labels on the rear of the Diamond-VT point to the appropriately related A and B power supplies.

- 1 Identify the power supply to be swapped on the rear of the unit.
- 2 Turn off the power supply on/off switch.
- 3 Disconnect AC line cord.
- 4 Unscrew the two screws on the power supply with the appropriate tool.
- 5 Pull power supply out of chassis using the power supply module handle.
- 6 Install new power supply in chassis with proper orientation (Power supply is keyed and can only be inserted one way).
- 7 Tighten the two screws on the power supply with the appropriate tool.
- 8 Connect AC line cord
- 9 Turn on power supply switch.
- 10 Verify correct operation by observing that the green light on the rear of the power supply is lit and that the appropriate power supply light on the system management card on the front of the unit is lit.



Note

It takes up to 30 seconds for the system to recognize the insertion or removal of a power supply and change the LED on the system

*removal of a power supply and change the LED on the system management board. The CLI will issue messages about the change (see *Diagnostics, Upgrade and Maintenance* on page 57).*

Blower Assemblies



CAUTION

Do not leave empty openings on the front or rear of the Diamond-VT under any circumstances. Empty openings affect airflow and may cause the unit to overheat and shut down.

The Diamond-VT contains two blower assemblies. The blowers are critical to proper array cooling operation. However, the array can operate with only one functional blower within certain ambient temperatures. The blowers are electronically connected to the power supplies and a power supply will not run without its corresponding blower assembly operating. This means if the blower adjacent to power supply A is removed, the 'A' power supply will shut down, turning off the corresponding LED on the system management card. The CLI will issue a message about the power supply being turned off.

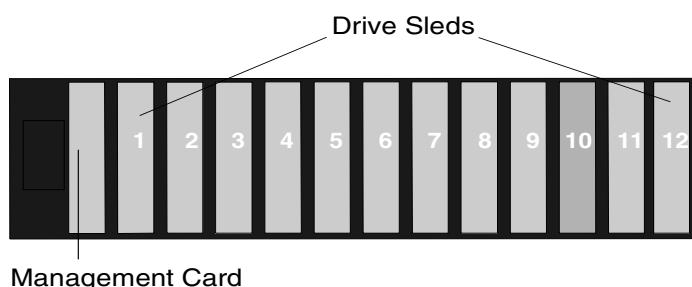
To replace a blower assembly

- 1 Unscrew the two screws on the blower assembly with the appropriate tool.
- 2 Pull the blower assembly out of chassis.
- 3 Install new blower assembly in chassis with proper orientation (Blower assembly is keyed and can only be inserted one way).
- 4 Tighten the two screws on the blower assembly with the appropriate tool.
- 5 Verify correct operation by observing that the green light is lit on the rear of the power supply, and that the appropriate power supply green light on the system management card on the front of the unit is also on.



Note

It takes up to 30 seconds for the system to recognize the insertion or removal of a power supply and change the LED on the system



Appendix A Glossary

The following terms are only a few examples of the language used for Fibre Channel, SCSI and storage systems. For more information, visit the websites of these professional organizations: the Fibre Channel Industry Association www.fibrechannel.org; the Fibre Channel Consortium www.iol.unh.edu/consortiums/index.html click on Fibre Channel; the Storage Area Networking Industry Association www.snia.org, or SCSI Trade Association www.scsita.org.

Fibre Channel technology

Fibre Channel (FC) is a serial communication interface designed to transfer large amounts of data among a variety of hardware systems over long distances. It is becoming a key technology for applications that require shared, high-bandwidth access to storage.

Fibre Channel provides a logical point-to point serial channel for the transfer of data between a buffer at a source device and a buffer at a destination device. It moves buffer contents from one port to another, without regard to the format or meaning of the data, allowing different upper level protocols to run over the Fibre Channel connection.

The Fibre Channel architecture is a hierarchical set of protocol layers. Defined within these layers are rules for signal interfaces, serial encoding and decoding, error control, frame format and communications protocols. Fibre Channel provides a range of implementation possibilities and purposely isolates the transmission medium from the control protocol so that each implementation may use the technology best suited to the application.

Fibre Channel arbitrated loop (FC-AL) technology allows 127 systems and devices to be distributed over

a range of up to 10 kilometers running at speeds of 1 gigabit/sec. Multiple FC-AL loops can be connected via a fabric switch topology to extend the range.

SAN technology

A Storage Area Network (SAN) is a shared storage architecture. SANs connect computers and storage devices for online data access. Each connected system can directly access any attached storage device. A SAN maintains greater fault tolerance and load balancing by supporting server clustering and fail-over (the ability for one server to take over for another in the event of a failure).

SCSI protocol

SCSI (pronounced scuzzy) stands for Small Computer System Interface, a processor-independent standard for system-level interface between a computer and SCSI devices such as hard disks, CD-ROM and printers, and to other computers and local area networks.

The protocol has many standards specifying data transfer rates, data width and speeds which allow SCSI devices to exchange data and control signals with a computer's CPU. Each device connected to a SCSI bus must have a different SCSI ID.

Term	Definition
arbitrate	process of selecting one L_Port from a collection of ports which ask for use of the arbitrated loop at the same time
arbitrated loop	a loop topology in which two or more ports are interconnected, but only two ports can communicate at one time
ATA	Advanced Technology Attachment: A disk drive interface standard, formerly called IDE; the ATA specification deals with the power and data signal interface of an integrated disk controller and drive
auto negotiation	hardware senses and automatically responds depending on configuration
CLI	Command Line Interface: used by applications and advanced users to perform diagnostic or configuration tasks; access is available through a computer terminal or terminal emulator via connections to the RS-232 port or the optional Ethernet management services card via the local area network using Telnet
fabric	A FC switch or two or more FC switches interconnected to physically transmit data between any two N_Ports on a switch or switches

Term	Definition
F_port	A port in the FC fabric where a N_port may attach
FC-AL	Fibre Channel Arbitrated Loop: an FC network in which up to 126 systems and devices are connected in a loop topology, with each transmitter connecting to the receiver of the device to its logical right; multiple FC-AL loops can be connected via a fabric switch
FL-port	A port in the FC fabric where a NL_port may attach in an arbitrated loop
firmware	Software stored in read-only memory (ROM) or programmable ROM; easier to change than hardware but more difficult to change than software stored on disk; firmware is responsible for the behavior of the system when it is first switched on
GBIC	A removable serial transceiver module which provides a connection between an external FC interface and a host interface board
host	a processor which communicates with devices over an interface
hot swapping	Components are removed and replaced while the unit is running, with power to either the component or a device connected to the unit
initiator device	A component which originates a command
JBOD	Just a Bunch of Disks: a storage subsystem of multiple independent disk drives
L_port	a port in an arbitrated loop, either a NL_port or a FL_port
LED	Light-emitting diode, a type of diode that emits light when current passes through it; visible LEDs are used as indicator lights on the Diamond-VT
LUN	Logical Unit Number: a SCSI or FC identifier of a device. A LUN is associated with a RAID group or Virtual Drive.
N_port	a port attached to a node used with point to point or fabric configurations
NL_port	a port attached to a node in FC arbitrated loop or fabric loop
originator	an initiating device; a component which originates a command
partition	a continuous range of addresses in a storage subsystem that appear as a logical unit; used to subdivide and manage a storage subsystem
port	an access point in a device: see N_port, NL_port, etc.
receiver	the ultimate destination of data transmission; a terminal device
RAID	originally Redundant Array of Inexpensive Disks, now Redundant Array of Independent Drives: a storage system spanning multiple disk drives. The following standard RAID specifications will be used here: RAID 0: non-redundant striped array; drives are accessed alternately, as if stacked one on top of the other; no data protection RAID 1: mirrored arrays: information written to one disk is also written to another simultaneously; provides complete data protection RAID 10: striping of mirrored groups RAID 5: striping across multiple disks offering redundancy by including a parity block in every stripe; the parity block is used to reconstruct the data if a single drive in the subsystem fails
SFP	Small Formfactor Pluggable: a removable transceiver which provides the connection between an external FC interface and a host interface
subpartition	a convenient term used to describe the allocation nature of a partition; a partition may be split into a number of subpartitions (each a partition in its own right) and a collection of contiguous subpartitions may be merged into a partition
topology	logical layout of the parts of a computer system or network and their interconnections
Virtual Drive	the presentation of a collection of disk drives as a single logical disk, also known as a RAID group.
Virtual Drive ID	a unique identifier associated with each Virtual Drive and displayed via CLI

Appendix B ATA Disk Technology

ATA is the dominant disk drive technology today and will be for the foreseeable future. It offers all the cost advantages of a mass produced, consumer-driven technology which is rapidly being driven forward. Today ATA also offers all the performance and reliability features needed to create high performance ATA-based disk storage arrays.

We view ATA as the perfect disk drive technology for “in-the-box” disk storage array solutions.

Aggregated Data Interface Technology (ADXT™) with its built-in Virtual Device Manager (VDM), Data Routing Fabric (DRF) and ATA Interface Engines (AIE) smoothly and efficiently organizes Fibre Channel data streams for storage or retrieval on ATA disk drives. ADXT provides end users with the power and sophisticated data control needed to take moderately priced ATA disk drives combine them in a disk storage array and power them to the performance levels of SCSI or Fibre Channel disk arrays.

Unlike other storage arrays which use expensive SCSI or Fibre Channel disk drives to achieve performance, the Diamond Series uses lower cost ATA disk drives combined with an intelligent midplane to create a storage array with exceptional price and performance characteristics.

Disk features and standards

ATA disk drives are used in the enormous PC marketplace and an estimated 85% of all disk drives sold today contain an ATA interface. Shipments of ATA drives are expected to grow rapidly over the next five years with increasing consumer and business demand. In general, ATA disk drives are the “driver” of all disk storage technology as the costs, volumes and demands of the PC marketplace are the primary focus of the world’s largest disk drive manufacturers.

ATA disk drives today offer capacities comparable to SCSI and FC disk drives – although at a tremendously lower cost. Advances in platter and head technology will push drive capacity along a very steep curve in the next five years. The chart below summarizes ATA and other disk interface standards. It clearly indicates that ATA drive technology offers characteristics that ideally suit it for “in the box” usage in high capacity, high performance disk arrays.

Feature	IDE	ATA	SCSI	Fibre Channel
Connectivity				
• Max Devices	2	2	16	126...millions
• Cable Length	46 cm	46 cm	25 m	10 km
Performance				
• Bandwidth	16 MB/sec.	100 MB/sec.	160 MB/sec.	200 MB/sec.
• Bandwidth/drive	8 MB/sec.	33 MB/sec.	10 MB/sec.	1.6 MB/sec.
• Multi-threaded I/O	No	Yes	Yes	Yes
Max Initiators	1	1	<16	125...millions
Topology	Bussed	Bussed	Bussed	Loop/Fabric
Error Detection	None	Yes	Yes	Yes
Protocol “weight”	very light	light	medium to heavy	heavy
• Cost	n/a	lowest	medium to high	highest
• Interface	n/a	lowest	medium to high	medium to high
• Drives				
Manageability	none	low to medium	medium	medium+

Appendix C Information Command Returns

Driveinfo

Sled	Capacity	Errors	TYPE	VDID	Capacity	Errors	TYPE	VDID
1	76292MB	0	JBOD	1	76292MB	0	JBOD	13
2	76292MB	0	JBOD	2	76292MB	0	JBOD	14
3	76292MB	0	JBOD	3	76292MB	0	JBOD	15
4	76292MB	0	JBOD	4	76292MB	0	JBOD	16
5	76292MB	0	JBOD	5	76292MB	0	JBOD	17
6	76292MB	0	JBOD	6	76292MB	0	JBOD	18
7	76292MB	0	JBOD	7	76292MB	0	JBOD	19
8	76292MB	0	JBOD	8	76292MB	0	JBOD	20
9	76292MB	0	JBOD	9	76292MB	0	JBOD	21
10	76292MB	0	JBOD	10	76292MB	0	JBOD	22
11	76292MB	0	JBOD	11	76292MB	0	JBOD	23
12	73307MB	0	JBOD	12	73307MB	0	JBOD	24

DriveInfo 7 2

JBOD VDID 19
Sled = 7, Drive = 2
Drive Model: Maxtor 98196H8
S/N: V80D15GC F/W Rev: ZAH814Y0 ATA Rev: 007e
Capacity: 76292 MB (09502790 blocks)
PIO: 03 MDMA: 07 UDMA: 07 QD: 00 CMDSet: 7c69 4309
Operations Blocks
Read 00000000 00000000
Write 00000000 00000000
Errors 00000000

DriveInfo RAID10 3

Drive 1				Drive 2				
Sled	Capacity	Errors	TYPE	VDID	Capacity	Errors	TYPE	VDID
1	76292MB	0	RAID10	56	76292MB	0	RAID10	56
2	76292MB	0	RAID10	56	76292MB	0	RAID10	56
3	76292MB	0	RAID10	56	76292MB	0	RAID10	56
4	76292MB	0	RAID10	56	76292MB	0	RAID10	56
5	76292MB	0	RAID10	57	76292MB	0	RAID10	57
6	76292MB	0	RAID10	57	76292MB	0	RAID10	57
7	76292MB	0	RAID10	57	76292MB	0	RAID10	57
8	76292MB	0	RAID10	57	76292MB	0	RAID10	57
9	76292MB	0	RAID10	58	76292MB	0	RAID10	58
10	76292MB	0	RAID10	58	76292MB	0	RAID10	58
11	76292MB	0	RAID10	58	76292MB	0	RAID10	58
12	73307MB	0	RAID10	58	73307MB	0	RAID10	58

DriveInfo 7 2

RAID10 VDID 57 State: ONLINE
RAID10 Member Index 5 of total members 8 disks
RAID10 Interleave Size 128 Blocks
Sled = 7, Drive = 2
Drive Model: Maxtor 98196H8
S/N: V80D15GC F/W Rev: ZAH814Y0 ATA Rev: 007e
Capacity: 76292 MB (09502790 blocks)
PIO: 03 MDMA: 07 UDMA: 07 QD: 00 CMDSet: 7c69 4309
Operations Blocks

Read 00000000 00000000
 Write 00000000 00000000
 Errors 00000000

LunInfo for a JBOD setup

LUN	TYPE	State	Capacity	Errors	SerialNumber
0	Processor	ONLINE	0MB	0	
1	JBOD	ONLINE	76292MB	0	V80EE4YCXAI0000
2	JBOD	ONLINE	76292MB	0	V80EE4HCXAI0000
3	JBOD	ONLINE	76292MB	0	V80DTESCXAI0000
4	JBOD	ONLINE	76292MB	0	V80DTCWCXAI0000
5	JBOD	ONLINE	76292MB	0	V80EE4TCXAI0000
6	JBOD	ONLINE	76292MB	0	V80CG4RCXAI0000
7	JBOD	ONLINE	76292MB	0	V80D44LCXAI0000
8	JBOD	ONLINE	76292MB	0	V80DTCXCXAI0000
9	JBOD	ONLINE	76292MB	0	V80DTELCXAI0000
10	JBOD	ONLINE	76292MB	0	V80ED9GCXAI0000
11	JBOD	ONLINE	76292MB	0	V80CFVHCXAI0000
12	JBOD	ONLINE	73307MB	0	YSDYSG9HXAI0000
13	JBOD	ONLINE	76292MB	0	V80EE4GCXAI0000
14	JBOD	ONLINE	76292MB	0	V80EE5LCXAI0000
15	JBOD	ONLINE	76292MB	0	V80DTDTCXAI0000
16	JBOD	ONLINE	76292MB	0	V80DTDLCXAI0000
17	JBOD	ONLINE	76292MB	0	V80EE4PCXAI0000
18	JBOD	ONLINE	76292MB	0	V80CLN4CXAI0000
19	JBOD	ONLINE	76292MB	0	V80D15GCXAI0000
20	JBOD	ONLINE	76292MB	0	V80DTDRCXAI0000
21	JBOD	ONLINE	76292MB	0	V80DTDYCXAI0000
22	JBOD	ONLINE	76292MB	0	V80EE5ECXAI0000
23	JBOD	ONLINE	76292MB	0	V80CG2GCXAI0000
24	JBOD	ONLINE	73307MB	0	YSDYSG9MXAI0000

LunInfo 13

ATADisk
 SerialNumber V80EE4GC XAI0000
 Sled = 1, Drive = 2
 Drive Model: Maxtor 98196H8
 S/N: V80EE4GCXAI0000 F/W Rev: ZAH814Y0 ATA Rev: 007e
 Capacity: 76292 MB (09502790 blocks)
 PIO: 03 MDMA: 07 UDMA: 07 QD: 00 CMDSet: 7c69 4309

Operations Blocks
 Read 00000000 00000000
 Write 00000000 00000000
 Errors 00000000

LunInfo for a RAID10 3

LUN	TYPE	State	Capacity	Errors	SerialNumber
0	Processor	ONLINE	0MB	0	
1	RAID10	ONLINE	305171MB	0	V80EE4YCAAL0000
2	RAID10	ONLINE	305171MB	0	V80EE4TCAAL0000
3	RAID10	ONLINE	293231MB	0	V80DTELCAAL0000

LunInfo 2

RAID10
 SerialNumber V80EE4TCAAL0000
 Virtual Drive ID 57, Capacity: 305171 MB (0x00025409e00 blocks)

Operations Blocks
 Read 00000000 00000000

A-v

Write 00000000 00000000
Errors 00000000

LunInfo for a RAID5 1 configuration

LUN	TYPE	State	Capacity	Errors	SerialNumber
==	==	=====	=====	=====	=====
0	Processor	ONLINE	0MB	0	
1	RAID5	ONLINE	1612749MB	0	V80EE4YC5AM0000

LunInfo 1

RAID5
SerialNumber V80EE4YC5AM0000
Virtual Drive ID 59, Capacity: 1612749 MB (0x000c4de6f00 blocks)
Operations Blocks
Read 00000000 00000000
Write 00000000 00000000
Errors 00000000

LunInfo for a RAID5 4 configuration

LUN	TYPE	State	Capacity	Errors	SerialNumber
==	==	=====	=====	=====	=====
0	Processor	ONLINE	0MB	0	
1	RAID5	ONLINE	305167MB	0	V80EE4YC5AN0000
2	RAID5	ONLINE	305167MB	0	V80DTCWC5AN0000
3	RAID5	ONLINE	305167MB	0	V80D44LC5AN0000
4	RAID5	ONLINE	293227MB	0	V80ED9GC5AN0000

LunInfo 4

RAID5
SerialNumber V80ED9GC5AN0000
Virtual Drive ID 62, Capacity: 293227 MB (0x00023cb5a00 blocks)
Operations Blocks
Read 00000000 00000000
Write 00000000 00000000
Errors 00000000

Part ID	Name	VDID	LUN	Capacity	StartVDLBA
=====	=====	=====	=====	=====	=====
0	0000	59	1	7629	1MB 0x000000000000
1	0001	59	5	7629	1MB 0x0009501f00
2	0002	59	6	7629	1MB 0x0012a03e00
3	0003	59	7	7629	2MB 0x001bf05d00
0	0000	60	2	30516	7MB 0x000000000000
0	0000	61	3	30516	7MB 0x000000000000
0	0000	62	4	29322	7MB 0x000000000000

PartitionInfo active 59 1

Part ID	Name	VDID	LUN	Capacity	StartVDLBA
=====	=====	=====	=====	=====	=====
0	0000	59	1	76291MB	0x000000000000
TYPE	VDID	#Parts	State	Capacity	Serial Number
=====	=====	=====	=====	=====	=====
RAID559	4	ONLINE	305165MB	V80EE4YC5AN
RAID5	60	1	ONLINE	305167MB	V80DTCWC5AN
RAID5	61	1	ONLINE	305167MB	V80D44LC5AN
RAID5	62	1	ONLINE	293227MB	V80ED9GC5AN

Volume	Partition	Total	% Capacity	Write		
ID	LUN	VDID	ID	Capacity	Used	Protection
059	-	59	0	3439315MB	0%	disabled
Ready.						

TapeVolumeInfo 059

Volume ID : 059
 LUN :
 VDID : 59
 Partition ID : 0
 Device Kind : RAID5
 Device State : OFFLINE
 Total Capacity : 3439315MB
 % Capacity Used : 0%
 Write Protection : disabled
 Primary Volume ID : G80FQC2E_____5AA0000
 Volume Sequence Number : 0

VirtualDriveInfo

TYPE	VDID	#Parts	State	Capacity	Serial Number
RAID5	59	4	ONLINE	305165MB	V80EE4YC5AN
RAID5	60	1	ONLINE	305167MB	V80DTCWC5AN
RAID5	61	1	ONLINE	305167MB	V80D44LC5AN
RAID5	62	1	ONLINE	293227MB	V80ED9GC5AN

VirtualDriveInfo active 59

TYPE	VDID	#Parts	State	Capacity	Serial Number
RAID5	59	4	ONLINE	305165MB	V80EE4YC5AN

VirtualDriveInfo active 59

TYPE	VDID	#Parts	State	Capacity	Serial Number
RAID5	59	4	ONLINE	305165MB	V80EE4YC5AN

Verbose return

ZoneInfo

ZoneInfo abcd
 Zone: abcd disabled
 Host: Remaining
 IID: none
 Port: 0
 Device: 123

ZoneInfo 1234

Zone 1234 disabled
 Host: 20:00:00:10:86:00:21:12
 IID: none
 Port: 0 1
 Device: 3 4 5 6
 ZoneInfo 1
 Zone: zone1 enabled
 Host: 20:00:00:10:00:00:00
 IID: none
 Port: 1
 Device: 12345

Appendix D Sample Zoning Command Sequences

First time configuration (after download)

QuickRAID under Zoning “first time” configuration, an all/all/all configuration in the selected QuickRAID configuration. All zone commands except

ZoneCommit affect only the planned configuration. *ZoneCommit* sets the Planned Configuration into the Active Configuration.

ZoneClearAll	Clears any previously-defined zones
ZoneCommit	Sets the new zoning configuration.

Simple configuration

2 hosts. Hosts can use different operating systems. All zone commands except *ZoneCommit* affect only the

planned configuration. *ZoneCommit* sets the Planned Configuration into the Active Configuration.

ZoneClearAll	Clears any previously defined zones from the planned configuration.
ZoneCreate zone_1	Creates a zone named zone_1
ZoneAddHost zone_1 20:00:00:10:86:00:01:34	Adds host WWPN to zone_1
ZoneAddDevice zone_1 1 4	Adds LUN 1 and 4 to zone_1
ZoneAddPort zone_1 0	LUN 1 and LUN 4 will be available through HIC 0 for only the host in zone_1
ZoneCreate zone_2	Creates a zone named zone_2
ZoneAddHost zone_2 20:00:00:60:00:00:12:34	Adds host WWPN to zone_2
ZoneAddDevice zone_2 7	Adds LUN 7 to zone_2
ZoneAddPort zone_2 1	LUN 7 will be available through HIC 1 for only the host in zone_2
ZoneState zone_1 enabled	Enables zone_1.
ZoneState zone_2 enabled	Enables zone_2.
ZoneCommit	Sets the Planned Zoning Configuration into the Active configuration. No other LUNs will be available to any host.

Symmetric Model

1 host, 1 switch. All host ports travel through a switch to both Diamond ports. Zoning is not required, since there is no reason to restrict host/HBA/Port access. All

zone commands except *ZoneCommit* affect only the planned configuration. *ZoneCommit* sets the Planned Configuration into the Active Configuration.

ZoneClear all	Clears any previously-defined zones from the planned configuration
ZoneCommit	Copies what is in the Planned Zoning Configuration to the Active Configuration: in this case, clears any previously-defined zones.

Asymmetric Model

3 hosts, 1 metadata controller (also a host), RAID 5 with 3 LUNs. All zone commands except *ZoneCommit* affect only the planned configuration. *ZoneCommit* sets the Planned Configuration into the Active Configuration.

ZoneClearAll	Clears any previously defined zones
ZoneCreate zone_1	Creates a zone named zone_1
ZoneAddHost zone_1 20:00:00:10:86:00:01:34	Adds host 1 WWPN to zone_1
ZoneAddHost zone_1 20:00:00:10:10:10:86:01	Adds metadata controller host WWPN to zone_1
ZoneAddDevice zone_1 1 2	Adds LUN 1 and LUN 2 to zone_1
ZoneAddPort zone_1 0	LUN 1 and LUN 2 will be available through HIC 0 for only the hosts in zone_1
ZoneCreate zone_2	Creates a zone named zone_2
ZoneAddHost zone_2 20:00:00:60:32:01:02:12	Adds host 2 WWPN to zone_2
ZoneAddHost zone_2 20:00:00:10:10:10:86:01	Adds metadata controller host WWPN to zone_2
ZoneAddDevice zone_2 1 2	Adds LUN 1 and LUN 2 to zone_2
ZoneAddPort zone_2 0	LUN 1 and LUN 2 will be available through HIC 0 for only the hosts in zone_2
ZoneCreate zone_3	Creates a zone named zone_3
ZoneAddHost zone_3 20:00:00:08:11:01:22:22	Adds host WWPN to zone_3
ZoneAddHost zone_3 20:00:00:10:10:10:86:01	Adds metadata controller host WWPN to zone_3
ZoneAddDevice zone_3 3	Adds LUN 3 to zone_3
ZoneAddPort zone_3 1	LUN 3 will be available through HIC 1 for only the hosts in zone_3
ZoneState zone_1 enabled	Enables Zone_1.
ZoneState zone_2 enabled	Enables Zone_2.
ZoneState zone_3 enabled	Enables Zone_3.
ZoneCommit	Sets the Planned Zoning Configuration into the Active configuration. No other LUNs will be available to any host.

Combined Symmetric/Asymmetric Model

Many hosts. All zone commands except *ZoneCommit* affect only the planned configuration. *ZoneCommit* sets the Planned Configuration into the Active Configuration.

ZoneClearAll	Clears any previously defined zones
ZoneCreate zone_1	Creates a zone named zone_1
ZoneAddHost zone_1 20:00:00:10:86:00:01:34	Adds host 1 WWPN to zone_1
ZoneAddHost zone_1 20:00:00:10:10:10:86:01	Adds host 2 WWPN to zone_1
ZoneAddDevice zone_1 1 2	Adds LUN 1 and LUN 2 to zone_1
ZoneAddPort zone_1 0	LUN 1 and LUN 2 will be available through HIC 0 for only the hosts in zone_1
ZoneCreate zone_2	Creates a zone named zone_2
ZoneAddHost remaining	Allows all other hosts (not host 1 or host 2) access to zone_2
ZoneAddDevice zone_2 3 4 5 6	Adds LUNs 3, 4, 5 and 6 to zone_2
ZoneAddPort zone_2 1	LUNs 3, 4, 5 and 6 will be available through HIC 1 for all hosts in zone 2 (excludes host 1 and host 2)
ZoneState zone_1 enabled	Enables Zone_1
ZoneState zone_2 enabled	Enables Zone_2
ZoneCommit	Sets the Planned Zoning Configuration into the Active configuration. No other LUNs will be available to any host.

Appendix E Specifications

Environmental and physical

- Humidity: 10-85% non-condensing
- Normal operating temperature at sea level: 5-40° C
- Storage temperature: -25-60° C
- AC input voltage 100-240V rated
- 50/60 Hz

Rack Mount Dimensions

- Height: 131mm (5.16") 3U
- Width: 447mm (17.60")

- Depth: 585mm (23.03")
- Approximately 39 kg (86 pounds) fully loaded with 24 drives

Floor Mount Dimensions

- Height: 524mm (20.62") 3U
- Width: 137mm (5.39")
- Depth: 595mm (23.42")
- Approximately 42 kg (92 pounds) fully loaded with 24 drives

Appendix F Product Safety

Safe handling of the Diamond-VT will help protect its components as well as the people working with them.

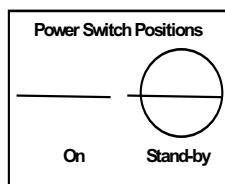
- The Diamond-VT is heavy (92 pounds for the floor model, 86 pounds for the rack mount system). Two people will be needed to move it safely.
- Mechanical, shock and energy hazards are present through the system if one or more of the modules is removed. There are no operator-serviceable components inside the unit except those indicated in *Hardware Maintenance* on page 67 and *Hot Swap Operating Instructions* on page 69 of this manual.



CAUTION

All modular components must be replaced by qualified personnel only.

- This equipment must be connected to a protective earth ground in accordance with the instructions provided in this guide. Improper grounding may result in an electrical shock.



- When the power supply green LED is on, the power source is fully operational, delivering power to the system. The only way to completely disconnect from the system is to remove the AC power cord from the back of the unit from both power supply inputs. The switch on the power supply is only a standby switch and does not disconnect the AC from the system.

AC power cord from the back of the unit from both power supply inputs. The switch on the power supply is only a standby switch and does not disconnect the AC from the system.

- This unit is designed to only have inside communication lines connected to it (no lines outside the building proper).
- The Diamond-VT must be provided with adequate air flow. To reduce the risk of damage, the ambient temperature of the inlet air should not exceed 40°C.
- Service personnel must follow proper grounding methods when working with or around the system because of the Diamond-VT's electrostatic sensitive components. Use a static wriststrap when handling any components from the Diamond-VT.

Safety compliances

- UL 1950 3rd Edition
- CSA 22.2 No. 950-95
- LEDs and fibre GBIC are Class 1 Laser Rated

EMC specifications

- EN 55022: class A
- EN 50204 RF Immunity 900 MHz Pulse
- EN 61000-4-8 Magnetic Immunity
- EN 61000-4-2: ESD
- EN 61000-4-3: Radiated Immunity
- EN 61000-4-4: EFT
- EN 61000-4-5: Surge
- EN 61000-4-6: Conducted Immunity
- EN 61000-4-11: Voltage Dips and Interruptions

Radio and television interference



WARNING

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Appendix G Part numbers

Each Diamond-VT has a master part number to identify it. The floor model base number is on the side of the unit. The rack mount part number is on the top of the unit and near the host interface cards.

Description	All models
System management card (Ethernet)	MGMT-ETHR-001
System management card (RS-232)	MGMT-R232-001
*Cable, 3 meter copper FC (unequalized) (1 Gb FC)	CBL-FCCU-003
*Cable, 10 meter copper FC (unequalized) (1GbFC)	CBL-FCCU-010
*Cable, 10 meter Fibre (1 Gb FC)	CBL-FCFI-010
*Cable, 3 meter optical LCLC (2 Gb FC)	CBL-LCLC-003
*Cable, 10 meter optical LCLC (2 Gb FC)	CBL-LCLC-010
*Cable, 3 meter SCSI VHDC	CBL-V68E-003
*Cable, 30 meter Fibre Channel (1Gb FC)	CBS-FCFI-030
CPCI Filler panel, 3U	CPCI-PANL-003
Blower assembly	DBLA-A001-000
Drive card, dummy	DDSL-0000-000
Dual Disk Drive Sled Assembly, 150 GB	DDSL-150G-000
Dual Disk Drive Sled Assembly, 160 GB	DDSL-160G-M00 DDSL160G-J00
Dual Disk Drive Sled Assembly, 320 GB	DDSL-320G-M00
Host Interface Card (GBIC Fibre Channel)	EPCI-FCCU-001
Host Interface Card (2 gigabit) Class 1 laser rated	EPCI-FCCU-002
Host Interface Card (Ultra 160 SCSI)	DHIC-U160-BLK
Power supply	DPWR-A001-001
*GBIC-DB9 (copper) AMP 788615-1 (1Gb FC)	GBIC-DB90-000
*GBIC-SW SC cnctr Class 1 laser rated (1Gb FC)	GBIC-SWFO-000
*Connector, SFP optical Class 1 laser rated (2 Gb FC)	SFP2-0000-000
*Terminator, 68-pin VHDCI	TERM-V68E-002

*All parts UL recognized

Appendix H Warranty

Manufacturer limited warranty

Manufacturer warrants to the original purchaser of this product that it will be free from defects in material and workmanship as described in the ATTO Technology website, www.attotech.com. Manufacturer liability shall be limited to replacing or repairing, at its option, any defective product. There will be no charge for parts or labor should Manufacturer determine that this product is defective.

Products which have been subject to abuse, misuse, alteration, neglected, or have been serviced, repaired or installed by unauthorized personnel shall not be covered under this warranty provision. Damage resulting from incorrect connection or an inappropriate application of this product shall not be the responsibility of Manufacturer. Manufacturer's liability is limited to Manufacturer's product(s); damage to other equipment connected to

Manufacturer's product(s) will be the customer's responsibility.

This warranty is made in lieu of any other warranty, express or implied. Manufacturer disclaims any implied warranties of merchantability or fitness for a particular purpose. Manufacturer's responsibility to repair or replace a defective product is the sole and exclusive remedy provided to the customer for breach of this warranty. Manufacturer will not be liable for any indirect, special, incidental, or consequential damages irrespective of whether Manufacturer has advance notice of the possibility of such damages. No Manufacturer dealer, agent or employee is authorized to make any modification, extension or addition to this warranty.

Contact ATTO Technology, Inc.

Customer service, sales information and technical support are available by phone Monday through Friday, Eastern Standard Time 8:00 a.m. to 8:00 p.m., or by fax and web site 24-hours a day.

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